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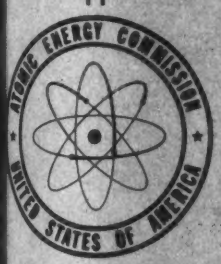

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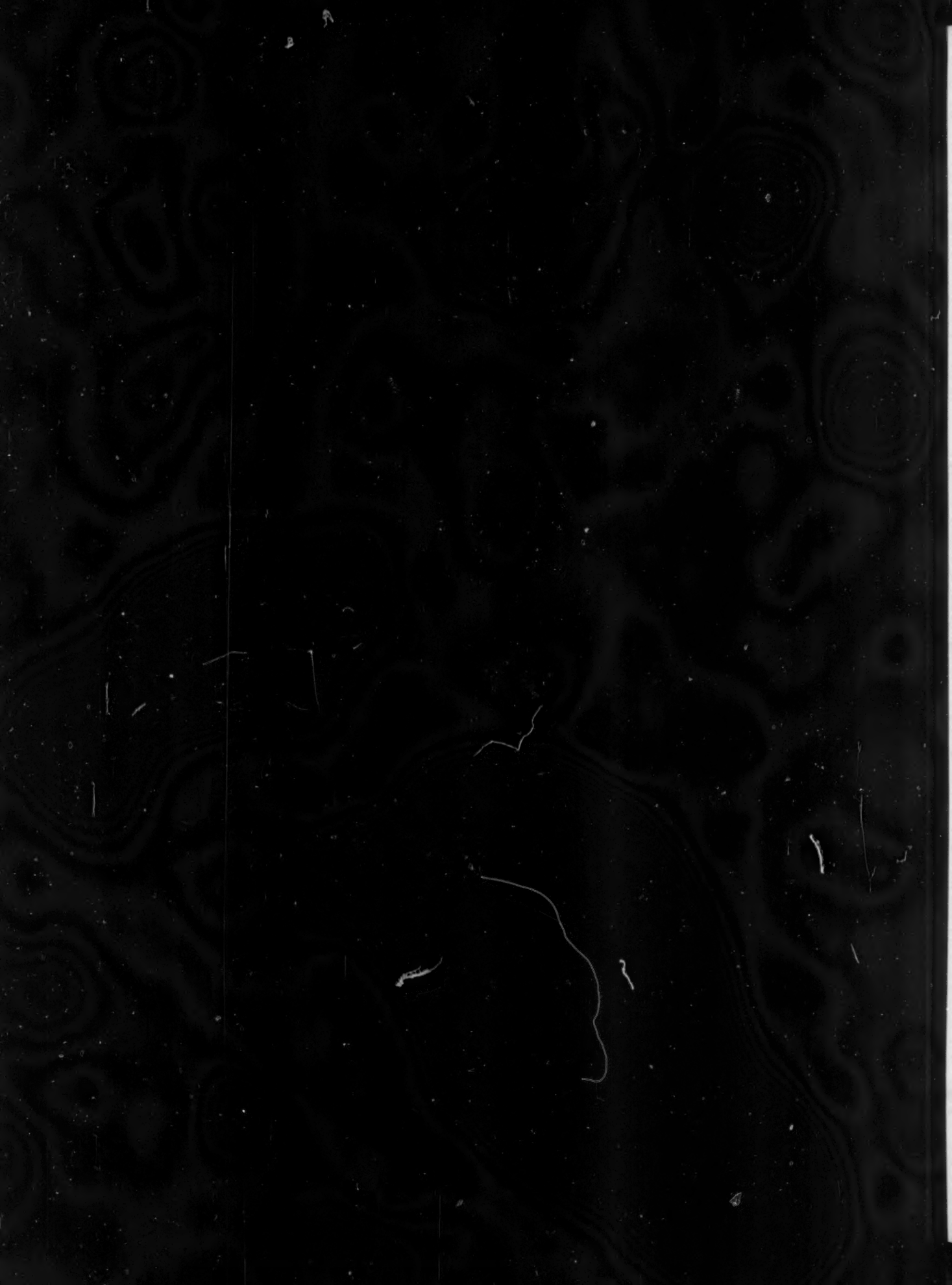

NUCLEAR SCIENCE ABSTRACTS

Volume 10 December 15, 1956 No. 23

GENERAL

ATOMIC POWER

11597
ATOMKRAFT. EINE STUDIE ÜBER DIE TECHNISCHEN UND WIRTSCHAFTLICHEN AUSSICHTEN VON ATOMKRAFTWERKEN FUR INGENIEURE, ENERGIEWIRTSCHAFTLER UND VOLKSWIRTE. (ATOMIC ENERGY. A STUDY OF THE TECHNICAL AND ECONOMIC ASPECTS OF ATOMIC POWER PLANTS FOR ENGINEERS, POWER INDUSTRIALISTS, AND POLITICAL ECONOMISTS). Friedrich Münzinger. Berlin-Gottingen-Heidelberg, Springer-Verlag, 1956. 93p. (In German)

RESEARCH PROGRAMS

11598
UNITED KINGDOM ATOMIC ENERGY AUTHORITY SECOND ANNUAL REPORT, 1955-56. London, Her Majesty's Stationery Office, 1956. 46p. $0.65 .

A non-technical report of all authority activities is presented. (D. E. B.)

11599
AUSTRALIAN A.E.C. RESEARCH PROGRAMME. C. N. Watson-Munro (Australian Atomic Energy Commission). Nuclear Eng. 1, 183-5(1956) Aug.

After a study of work being done in other countries, the A.A.E.C. decided that its attention could most profitably be devoted to feasibility studies of the gas-cooled impregnated moderator fuel element type and liquid-metal cooled reactors. To this end the research station at Lucas Heights is to have a high-flux experimental reactor similar to DIDO. (auth)

11600
JAPAN SPEEDS ORGANIZATION OF NUCLEAR PROGRAM. Clark Goodman (U. S. Atomic Energy Commission, Washington, D. C.). Nucleonics 14, No. 9, 104-7(1956) Sept.

The atomic energy law of Japan, which became effective in January 1956, establishes 5 organizations for administration of the nuclear program. These are described along with the other important segments of the atomic organization. (T.R.H.)

BIOLOGY AND MEDICINE

11601 HW-41638
Hanford Atomic Products Operation, Richland, Wash.
BASIC ANATOMICAL, DIETARY, AND PHYSIOLOGICAL DATA FOR RADIOLOGICAL CALCULATIONS. L. K. Bustad and J. L. Terry. Feb. 24, 1956. 12p. Contract W-31-109-eng-52. $0.15(OTS).

Anatomical, physiological, and nutritional data for a number of domestic animals and nutritional data for adults and children are presented in tabular form. (C.H.)

11602 UCRL-3451
California. Univ., Berkeley. Radiation Lab.
ESTIMATION OF ATHEROGENIC INDEX AND ACCUMULATED CORONARY DISEASE IN HUMAN MALES: EVALUATION FROM SERUM GRAVIMETRIC "TOTAL LIPID" OR TOTAL CHOLESTEROL CONCENTRATION. Alex V. Nichols, Frank T. Lindgren, and John W. Gofman. June 26, 1956. 20p. Contract W-7405-eng-48. $0.20(OTS)

11603
THIAMINE DEFICIENCY ENCEPHALOPATHY IN CATS. K. V. Jubb, L. Z. Saunders, and Helen V. Coates (N. Y. State Veterinary Coll., Ithaca and Brookhaven National Lab., Upton, N. Y.). J. Comp. Pathol. 66, 217-27(1956).

11604
TUMOR NECROSIS AFTER THE INTRA-TUMOR INJECTION OF CHEMICAL AGENTS AND COLLOIDAL RADIOISOTOPES. S. W. Mayer and M. E. Morton (V. A. Hospital, Long Beach, Calif. and Univ. of California School of Medicine, Los Angeles). Experientia 12, 322-3(1956) Aug. (In English)

11605
DIGITAL COMPUTER STUDIES OF CELL MULTIPLICATION BY MONTE CARLO METHODS. Joseph G. Hoffman (Roswell Park Memorial Inst., Buffalo) and Nicholas Metropolis and Verna Gardiner (Los Alamos Scientific Lab., N. Mex.). J. Natl. Cancer Inst. 17, 175-88 (1956) Aug.

The Monte Carlo method of generating cell populations is described for cells in which the intermitotic time and duration of mitosis occur randomly. Three different kinds of growth processes are studied in which the rest period between divisions and the spread of intermitotic times are varied. The effect of the stochastic process on the cell populations in exponential multiplication is shown to bring about a distribution of population sizes and to introduce a latent period in their growth. The incidence of mitosis in the cell populations follows the Poisson distribution in all 3 cases studied. The age distribution and the distribution of population sizes are sensitive to the distribution of intermitotic times. The Monte Carlo method and the digital computer provide a methodological approach to the growth of cell populations. The results permit a ready comparison with experimental data. (auth)

RADIATION EFFECTS

11606 AF-SAM-56-18
School of Aviation Medicine, Randolph AFB, Texas
THE EFFECT OF REDUCED FOOD INTAKE ON THE HYPERLIPOPROTEINEMIA OF LOCAL RADIATION INJURY. Norman Weiner, Lawrence J. Milch, and Gordon E. Shults. May 1956. 4p.

The possible effect of voluntary food reduction on the hyperlipidemia and weight loss produced in rabbits after acute local radiation injury was investigated. Pair-fed controls did not develop significantly elevated plasma lipid and lipoprotein levels and did not lose weight, as did their injured mates. (auth)

11607 ANL-5597
Argonne National Lab., Lemont, Ill.
BIOLOGICAL AND MEDICAL RESEARCH DIVISION

QUARTERLY REPORT [FOR] APRIL, MAY, JUNE 1956. July 1956. 102p. Contract W-31-109-eng-38. $0.55 (OTS).

Progress is reported in the following studies: the transplantability of both Krebs and Ehrlich mouse ascites carcinoma in rats; the toxicity of Sr^{90} and of Ca^{45} in mice; the effects of total-body exposure to x radiation on the blood circulation in roosters; the effects of continuous exposure to γ radiation on spermatogenesis in mice; the incidence of mortality and leukemia in mice exposed to 5 different daily γ radiation dosage levels; the effects of Po^{210} injected in the ovaries on the fertility of mice; the pathological effects of drinking D_2O in rats; the development of methods for the colorimetric and chromatographic determination of indoleacetic acid in plant preparations; tracer studies of auxin transport in plants; the growth-regulating properties of auxins; the effect of implanted spleens on the sensitivity of mice to gamma and neutron irradiation; the effect of paired equal doses of Co^{60} γ radiation on 30-day mortality in the mouse; the survival of giant amoebae after single exposures to fission neutrons; the survival of the four-day chick embryos following Co^{60} γ irradiation; the retention of Sr^{85} in rats as a function of animal age at injection; the metabolism of Ca^{45} in the soft tissues in young rats; an investigation of the possibility of using the phage-cofactor-bacterium interaction as the basis of an enzyme-counting technique; application of γ-ray spectrometry to multiple-tracer studies; and an investigation of the possible role of amine oxidase in auxin biosynthesis in the pea. (For preceding period see ANL-5576.) (C.H.)

11608 UCRL-3479

California. Univ., Berkeley. Radiation Lab.
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] APRIL, MAY, JUNE 1956. July 30, 1956. 22p. Contract W-7405-eng-48. $0.25(OTS).

Data are presented from the following studies: the long-term effects of intramuscularly administered Ra^{223} on rats; the body-burden and excretion in an infant monkey of Sr^{90} acquired by placental connection with the mother; the indirect and direct action of radiation on aqueous glycine and on acetic acid in oxygen-aerated solution; the indirect action of radiation on compounds containing the N-C bond; the response of chemical actinometers to cyclotron radiations; the alteration of a sarcoma by heterologous transplantation in cortisone-treated mice; and routine personnel monitoring procedures. (For preceding period see UCRL-3386.) (C.H.)

11609 UR-462

Rochester, N. Y. Univ. Atomic Energy Project.
ACUTE LETHALITY OF PARTIAL BODY IN RELATION TO WHOLE BODY IRRADIATION. H. A. Blair. Sept. 10, 1956. 10p. Contract W-7401-eng-49. $1.80(ph OTS); $1.80(mf OTS).

If to cause acute death from radiation the same amount of lethal substance or injury must be produced, whether the whole-body or segments thereof are irradiated, it is shown that the reciprocal of LD_{50} for the whole body, will be equal to the sum of the reciprocals of LD_{50} for the separate segments, all doses being measured in roentgens. Existing data are compatible with this view but they involve irradiation of large segments of the body. For small segments undoubtedly the rule will fail. Some general aspects of partial-body irradiation are discussed. (auth)

11610

EFFECT OF SEED TREATMENTS WITH X-RAY AND PHOSPHORUS 32 ON TOMATO PLANTS OF FIRST, SECOND, AND THIRD GENERATIONS. J. W. Lesley and Margaret M. Lesley (Univ. of California Citrus Experiment Station, Riverside). Genetics 41, 575-88(1956) July.

11611

THE PRODUCTION OF TWO CHEMICALLY DIFFERENT TYPES OF CHROMOSOMAL BREAKS BY IONIZING RADIATIONS. Sheldon Wolff and Henry E. Luippold (Oak Ridge National Lab., Tenn.). Proc. Natl. Acad. Sci. U.S. 42, 510-14(1956) Aug.

Experiments on the seed of V. faba indicate that radiation-induced chromosome breaks may have two chemically different natures. One seems to be an ionic break, which closes very rapidly, as would be expected if only electrical factors were necessary for its rejoining. The other is covalent, and it stays open for long periods of time and needs a source of energy for the biosynthesis of the bonds formed in its closing. Such apparently unrelated experimental results as those obtained by the use of calcium deficiency, chelating agents, metabolic inhibitors, and high-intensity radiation can be united by this concept of two types of chromosomal damage. (auth)

11612

GENETIC DIVERGENCE OF ISOLATED POPULATIONS OF DROSOPHILA MELANOGASTER. Bruce Wallace. Cytologia, Suppl., 761-4(1954).

11613

STUDIES ON IRRADIATED POPULATIONS OF DROSOPHILA MELANOGASTER. Bruce Wallace (Biological Lab., Cold Spring Harbor, N. Y.). J. Genet. 54, 280-93(1956) May.

11614

THE I^{131}-IRRADIATED RAT THYROID: ITS ALTERED RESPONSE TO VARIOUS STIMULI AND THE CHANGES INDUCED IN ITS IODINE METABOLISM. G. D. Potter, Alvin Taurog, and I. L. Chaikoff (Univ. of California School of Medicine, Berkeley). Endocrinology 59, 12-26(1956) July.

Rats were injected with carrier-free doses of I^{131} ranging from 5 to 300 μc. Radiation dosage to the thyroid gland was calculated from in vivo uptake and disappearance of I^{131} from the glands. Two to 5 weeks after the I^{131} injection, the irradiated thyroids were compared with control thyroids with respect to iodide-concentrating capacity, synthesis of organic I^{131} compounds, response to the feeding of propylthiouracil, response to cold, response to TSH injection, and cytology. The most sensitive index of radiation damage to the thyroid gland was diminished growth response to stimuli that normally produce hypertrophy and hyperplasia. Cytological changes were also noticeable at relatively low radiation doses. A reduction in the iodide-concentrating mechanism of the thyroid was observed only after relatively large doses of radiation. The ability of the thyroid gland to form I^{131}-thyroxine and other organic I^{131}-compounds was possibly as sensitive to radiation damage as was the iodide-concentrating capacity. Even after the thyroids had been exposed to the highest radiation dosage employed in the present study (50,000 rep.), the distribution of I^{131} among the various iodine compounds of the gland was indistinguishable from normal. It appears, from the data obtained here, that those thyroid processes concerned with growth are more sensitive to radiation than are those concerned with iodine metabolism. (auth)

11615

THE X-RAY SENSITIVITY OF CUTTINGS OF CREEPING-ROOTED ALFALFA. Beatrice E. Murray (Central Experimental Farm, Ottawa, Canada). Can. J. Agr. Sci. 36, 120-6(1956) Mar.-Apr.

A method for the determination of radiosensitivity of alfalfa is presented. Alfalfa stem cuttings were exposed to 9 dosage levels of x radiation, namely, control (no radiation), 500r, 1000r, 2000r, etc., to 7000r, subsequent to the initiation of root primordia at the base of each cutting. A reduction in the lengths and the number of roots per cutting was the initial manifestation of sensitivity to x radiation. Comple-

mentary information was contributed by axillary bud growth and leaf anomalies. No irradiation effects on root or axillary bud growth were visible in cuttings exposed to the 1000r level or less. Growth of both roots and axillary buds was inhibited at dosage levels of 5000r or more. Adventitious stems developed on the roots at the base of cuttings if the rooting portion were shielded from x radiation. (auth)

11616

RADIOACTIVITY INJURY AND RECOVERY FROM IONIZING RADIATION EXPOSURE. Joe W. Howland (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Ann. Rev. Med. 7, 225-44(1956).

A survey of literature on the biological effects of ionizing radiations in animals and man is reported. Concepts of cellular damage, chemical factors modifying the effect of radiation, the role of spleen and bone marrow in recovery, the nature of infection, hemorrhage, and anemia in radiation injury, endocrine response, and irreversible effects of radiation injury are discussed in detail. (F.S.)

11617

THE EFFECT OF FORMALDEHYDE ON THE MUTAGENIC ACTION OF X-RAYS IN DROSOPHILA. F. H. Sobels (Institute of Genetics of the State University, Utrecht, Netherlands). Experientia 12, 318-21(1956) Aug. (In English)

11618

LONG-TERM RADIATION OF BONE FOLLOWING ADMINISTRATION OF C^{14}-BICARBONATE. Howard E. Skipper, Linda Simpson, and Martelia Bell (Southern Research Inst., Birmingham, Ala.). Proc. Soc. Exptl. Biol. Med. 92, 549-50(1956) July.

Studies have been carried out on retention of C^{14} from labeled bicarbonate in the bones of mice. A single dose of 100 μc per mouse (a 280 millicurie man-equivalent) provided daily radiation of the most active areas of the long bones of above 0.05 rep/day for a period of approximately one year. (auth)

11619

THE EFFECTS OF CONTINUOUS IRRADIATION BY TRITIUM ON CELLS CULTIVATED IN VITRO. Agnes N. Stroud (Argonne National Lab., Lemont, Ill.). Ann. N. Y. Acad. Sci. 67, Art. 2, 11-34(1956) Aug. 29.

The effects of continuous irradiation with tritium oxide on chick embryo skeletal muscle tissue cultures were studied by means of stained preparations, time-lapse cinematographs, and serial photographs of large areas. Irradiation was delivered by the incorporation of tritium oxide into the water of the culture medium, which permitted observations to be made safely during irradiation. Data are summarized. (auth)

11620

A CORRELATION OF EARLY RADIATION CHANGES IN LYMPHATIC TISSUES WITH ANTITOXIN-PRODUCING ABILITY. William L. Williams, Richard D. Stoner, and William M. Hale (Univ. of Tennessee, Memphis and Brookhaven National Lab., Upton, N. Y.). Yale J. Biol. and Med. 28, 615-21(1956) June.

Results are reported from experiments which correlate the morphological changes in lymphatic tissues following gamma irradiation with the alteration in ability of the animal to produce antitoxin, and the morphology of aging of the thymus with its increasing ability to produce antitoxin in transplants. We believe we have demonstrated the ability of undifferentiated cells of the reticulo-endothelial system to produce antibodies in the absence of mature lymphocytes or plasma cells. (auth)

11621

OBTAINING NEW FORMS OF PLAGUE (B.pestis Ev_{16}) VACCINE FOLLOWING IRRADIATION. V. I. Ivanov, M. D. Pryadkina, and V. M. Vedeshkina (Tarasevich Inst. of Vaccine and Serum Control). Med. Radiol. No. 2, 52-6(1956) Mar.-Apr. (In Russian)

11622

INCORPORATION OF PHOSPHORUS INTO NUCLEIC ACID IN STABLE AND LABILE COMPOUNDS IN WHITE MICE ORGANS DURING TOTAL IRRADIATION. A. S. Orlov (Central Research Inst. of Roentgen-Radiology). Med. Radiol. No. 2, 65-70(1956) Mar.-Apr. (In Russian)

11623

REACTIONS OF GROWING ORGANISM TO THE EFFECTS OF PENETRATING RADIATION IN MASSIVE DOSES. V. V. Kholin (Orden of Lenin Inst. of Med. Radiology). Med. Radiol. No. 2, 75-80(1956) Mar.-Apr. (In Russian)

11624

COMPARISON OF BIOLOGICAL EFFECTS PRODUCED BY X-RAY AND RADIOACTIVE COBALT γ RADIATION. S. N. Aleksandrov, K. F. Galkovskaya, and Yu. G. Zil'berg (Central Research Roentgen-Radiological Inst.). Med. Radiol. No. 2, 80-7(1956) Mar.-Apr. (In Russian)

11625

EFFECTS OF X RADIATION ON THE NERVOUS SYSTEM OF ANIMALS (WHITE RATS). L. I. Kotlyarevskiĭ, L. S. Gorsheleva, and L. E. Khozak (Inst. of Nervous System, Acad. of Med. Science S.S.S.R.). Med. Radiol. No. 3, 11-19 (1956) May-June. (In Russian)

11626

INTERACTIONS OF LYMPH NODES DURING IRRADIATION. Yu. M. Zaretskaya. Med. Radiol. No. 3, 20-9(1956) May-June. (In Russian)

11627

EFFECTS OF IONIZING RADIATION OF THE PENETRABILITY AND FUNCTIONS OF EYE VESSELS. N. I. Arlashchenko. Med. Radiol. No. 3, 29-35(1956) May-June. (In Russian)

11628

EFFECTS OF PARATYPHOID INFECTION OF ANIMALS EXPOSED TO TOTAL X RADIATION. V. N. Sivertseva (Central Research Inst. of Roentgen-Radiology). Med. Radiol. No. 3, 52-9(1956) May-June. (In Russian)

11629

EFFECTS OF X RADIATION ON ORGANISMS TREATED WITH ANTI-TETANUS SERUM. G. N. Kryzhanovskiĭ and N. N. Lebedev. (Inst. of Normal and Pathological Physiology, Acad. of Med. Science S.S.S.R.). Med. Radiol. No. 3, 59-62(1956) May-June. (In Russian)

Exposure of rats to x radiation of 400 r, 10 to 12 minutes before anti-serum injection, did not produce any complications and did not reduce the prophylactic and therapeutic effects of the serum. (R.V.J.)

11630

FREE AMINOACIDS IN BONE MARROW AND THE EXCHANGES CAUSED BY X RADIATION. B. S. Kasavina and E. B. Spector (Central Inst. of Traumatology and Orthopedics). Med. Radiol. No. 3, 72-80(1956) May-June. (In Russian)

11631

SOME DATA ON THE MECHANISM OF FETUS DAMAGE IN ANIMALS EXPOSED TO X RADIATION. N. A. Kalinina (Inst. of Gynecology Acad. of Med. Science S.S.S.R.). Med. Radiol. No. 3, 92-6(1956) May-June. (In Russian)

11632

THE PROBLEM OF TOTAL AND PARTIAL BODY IRRADIATION. B. Rajewsky. Strahlentherapie 100, 5-15(1956) May. (In German)

The time of survival of rats, mice and guinea-pigs has been examined within a range of doses from 100 to 200,000

r. Between 1200 and 15,000 r, the animals die after 3.5 days. In order to clear the cause of decease, intra-operative irradiation of certain body regions or organs was carried out. The irradiation of adrenalectomized, hypophysectomized and splenectomized rats has shown the great importance of the system of the hypophysis and the cortex of the suprarenal body for the 3.5 days effect. Furthermore, the author has examined the secretion of the adrenal cortical hormones and tissue metabolism. (auth)

11633

THE EFFECT OF TOTAL RADIATION WITH AND WITHOUT A LEAD SCREEN ON THE SERUM ALBUMIN OF EXPERIMENTAL ANIMALS. Robert Bauer, Siegmund Piller, and Gerhard Schneider. Strahlentherapie 100, 16-29(1956) May. (In German)

By means of the plasma protein picture, and of the corpuscular blood picture as well as the bone marrow studies, the authors examine the effect to total roentgen irradiations with and without lead screen on white rats. There can be observed gradually differing changes which are dependent on the dose administered. Particularly striking is the comparison between the rats irradiated with 1200 r without lead screen and those irradiated with 3600 r with lead screen. The smaller extent of the dysproteinemia and the nearly complete reparation perceptible in the plasma protein picture as well as in the bone marrow is characteristic for the latter. (auth)

11634

RADIOSENSITIVITY OF IMMUNE RESPONSE BETWEEN TUMOR AND HOST ORGANISM. PART I. HETEROLOGOUS TRANSPLANTATION OF EHRLICH ASCITES TUMOR OF THE MOUSE INTO IRRADIATED AND NON-IRRADIATED RATS. Werner Lorenz. Strahlentherapie 100, 104-12(1956) May. (In German)

By means of 248 rats and 55 mice it was possible for the first time, to carry out the intraperitoneal transplantation of Ehrlich's ascites carcinoma of the mouse in the non-irradiated rat (27%), in the rat immediately before exposed to a total roentgen irradiation of 250 r (57%), and in the rat exposed to a total roentgen irradiation of 500 r (78%). The further inoculation from the rats exposed to a dose of 500 r was successful in the second rat passage in 59.6% of the cases, from the rats exposed to a dose of 250 r in 33% of the cases, from the non-irradiated rats, however, in no case. Also in the re-inoculation into the non-treated mouse only the tumors taken from rats which had been exposed to 250 r and 500 r, yielded positive results. (auth)

11635

REACTIVE PROCEEDINGS AFTER GENERAL AND LOCAL IRRADIATION. Theophil Hornykiewytsch and Hans-Stephan Stender. Strahlentherapie 100, 113-20(1956) May. (In German)

The course of reactions after total or local irradiation is decisively influenced by the initial conditions of the organism. This effect can be observed especially if certain organs are under the specific influence of stimulants. (auth)

11636

THE SIGNIFICANCE OF THE REGULATING FACTORS OF RADIATION REACTION IN BONE MARROW. Helmut Hartweg. Strahlentherapie 100, 121-8(1956) May. (In German)

By means of comparisons between total and local irradiation the regulating factors in the bone marrow have been examined. The results show that there are intense extramedullary impulsions in the stage of damage and especially during the reparation. The marrow being not damaged by the local irradiation imitates in a weaker form the reaction of the marrow being damaged by the rays. (auth)

11637

THE EFFECT OF DOSE PROTRACTION AND FRACTIONATION ON THE SKIN REACTION DURING IRRADIATION WITH Sr^{90}. Apostoulos Yiannakopoulos and Kurt Ernst Scheer. Strahlentherapie 100, 165-8(1956) May. (In German)

The authors have made tests on 5 persons to examine the dependence of skin reaction on protraction and fractionation in case of irradiation with strontium-90. Two strontium-90 preparations were applied with superficial doses of 4400 rep/minute and 180 rep/minute. The results have proved that protraction as well as fractionation lead to considerable less formation of erythemas. For the clinical use of strontium-90 preparations of highest dose power, fractionated irradiation seems to be recommendable whenever the application of a high total dose is of main interest. (auth)

11638

CYTOLOGICAL INVESTIGATION OF RADIATION EFFECT ON THE LIVER AND SPLEEN. PART II. INVESTIGATION OF THE SPLEEN. Eberhard Scherer. Strahlentherapie 100, 211-24(1956) June. (In German)

Results of quantitative cytological methods indicate the liver is an extremely radio-sensitive organ; the reticulum cells of the spleen, which have formerly been thought radio-resistant, are subject to distinct changes suggesting that these cells are most important in the defensive activity; and the observed cell changes can be provoked also by irradiation of the head or other remote regions of the body, the result being typical for each different case. (auth)

11639

THE EFFECT OF SMALL RADIATION DOSES ON THE SPLEEN AND THYMUS OF THE RAT AFTER A SINGLE AND REPEATED APPLICATION. Rosemarie Fluhr, Lothar Weib, and Wolfgang Gehlen. Strahlentherapie 100, 225-40(1956) June. (In German)

The authors have studied the effect of small roentgen doses (10 r, 3 times 10 r, 30 r, 50 r) on the spleen and thymus of white rats. After irradiation of 10 r there were no changes; the application of 3 times 10 r caused distinct injury, above all in the spleen; 30 r provoked considerable activation of spleen and thymus; 50 r caused slight injury up to the 12th day, then activation of spleen and thymus. (auth)

11640

RADIATION DOSAGE AND CELL DECOMPOSITION. Eberhard Koch, Theophil Hornykiewytsch, and Hans Stephan Stender. Strahlentherapie 100, 253-8(1956) June. (In German)

The behavior of leucocytic decomposition cells of the rat, 6 hours after an irradiation of the whole body with 5 to 1200 r can be characterized by a dose effect curve, which shows a rectilinear course in the logarithmic screen. The authors discuss the possibility to estimate the administered dose of rays by determining the number of the decomposition cells. (auth)

11641

ON THE SERUM-ALBUMIN CHANGE UNDER THE INFLUENCE OF IONIZING RAYS. H. Eberle and Julius Ries. Strahlentherapie 100, 269-74(1956) June. (In German)

By means of our own electrophoretic examinations as well as after the original method explained by Takata we have not succeeded in reproducing the effect called vital ionization, which means, that the irradiation of an experimental person or the application of a direct current, respectively, should have a regular influence on the serum-albumin quality. By means of the paper-electrophoresis the serum-albumin picture of patients treated with x-rays or radium has been controlled after the irradiation. (auth)

11642
ON THE PATHOLOGICAL CHANGES IN PULMONARY TISSUE AFTER HIGH DOSES OF X RADIATION. Harold Henzi. Strahlentherapie 100, 275-90(1956) June. (In German)

The author describes the changes of the pulmonary tissue after irradiation with high doses of ionizing rays. The irradiation entails lesions of the capillary wall, extravasation of liquid blood constituents with imbibition of the tissue, reaction of local cells and warping of the collagenic substance. Afterwards, a tendency towards fibrozation of the tissue can be observed. The process is compared with the virulent pneumonias and with the classical definition of the inflammation. The frequent bronchopneumonia is a secondary complication. (auth)

11643
INTRAUTERINE EMBRYO-INJURY BY X-RADIATION. Marko Bašić and Danica Weber. Strahlentherapie 99, 628-34(1956) Apr. (In German)

The report deals with the case of a 3 years old girl suffering from microcephalia, cerebral atrophy, idiocy, anomalies of both eyes, considerable retardation of growth especially in the lower parts of the body and the lower left extremity, formation of an exostosis on the proximal tibia metaphysis, generally spread anomalies of skin pigmentation and motorial disturbances of the extremities. In the first half of her intra-uterine life, the child had unintentionally been exposed to x-rays, which were applied to the postoperative metastases of a mamma carcinoma of the meanwhile deceased mother. The case is discussed with regard to the problem of indication of eugenic pregnancy interruption. (auth)

11644
RADIATION-INDUCED CHANGES IN REACTIVITY OF BOVINE FIBRINOGEN. Peter Rieser and Robert J. Rutman (Univ. of Pennsylvania, Philadelphia). Nature 178, 257-8 (1956) Aug. 4.

11645
POLYPLOIDY AND RADIOSENSITIVITY. Alan D. Conger and A. Helen Johnston (Oak Ridge National Lab., Tenn.). Nature 178, 271(1956) Aug. 4.

11646
EFFECTS OF IONIZING RADIATIONS OF SERUM COMPLEMENT AND ENZYMES. P. J. Handoll, J. Rotblat, E. D. Wills, and A. Wormall (St. Bartholomew's Hospital, London). Nature 178, 307(1956) Aug. 11.

11647
MUTAGENIC EFFECT OF THERMAL NEUTRONS ON WET AND DRY TOMATO SEED. A. B. Burdick (Purdue Univ., Lafayette, Ind.). Nature 178, 360-1(1956) Aug. 18.

11648
EFFECT OF X-RAYS ON MITOCHONDRIAL DESOXYRIBONUCLEASE II. S. Okada and E. Kallee (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Exptl. Cell Research 11, 212-14(1956) Aug.

11649
RADIATION-INDUCED FISSION BLOCK IN SYNCHRONIZED CULTURES OF TETRAHYMENA PYRIFORMIS W. H. S. Ducoff (Argonne National Lab., Lemont, Ill.). Exptl. Cell Research 11, 218-20(1956) Aug.

11650
INVESTIGATION OF THE LETHAL EFFECT OF X-IRRADIATION ON THE YOUNG AXOLOTL (SIREDON MEXICANUM). V. V. Brunst (Roswell Park Memorial Inst., Buffalo). Radiation Research 5, 267-80(1956) Sept.

11651
THE COMPARATIVE EFFECTIVENESS OF FOUR BETA-EMITTING ISOTOPES FED TO HABROBRACON FEMALES ON PRODUCTION AND HATCHABILITY OF EGGS. Daniel S. Grosch, Robert L. Sullivan, and Leo E. LaChance (North Carolina State Coll., Raleigh). Radiation Research 5, 281-9(1956) Sept.

11652
FIVE- TO EIGHT-DAY RADIATION DEATH IN MICE. Mildred K. Austin, Morton Miller, and Henry Quastler (Univ. of Illinois, Urbana). Radiation Research 5, 303-7 (1956) Sept.

11653
EARLY HYPOTENSION INDUCED IN THE RABBIT BY WHOLE BODY X-IRRADIATION. Phillips M. Brooks, Herbert B. Gerstner, and Sidney A. Smith (USAF School of Aviation Medicine, Randolph Field, Tex.). Am. J. Physiol. 186, 532-6(1956) Sept.

11654
LIVER FUNCTION IN THE CHICK FOLLOWING X-IRRADIATION. PLASMA AMINO ACIDS AND PLASMA GLUCOSE. Elaine Katz Bernstein, S. Phyllis Stearner, and Austin M. Brues (Argonne National Lab., Lemont, Ill.). Am. J. Physiol. 186, 543-8(1956) Sept.

11655
EFFECT OF TOTAL BODY IRRADIATION ON ABSORPTION OF SUGARS FROM THE SMALL INTESTINE. John T. Farrar, Melvin D. Small, Doris Bullard, and Franz J. Ingelfinger (Massachusetts Memorial Hospitals and Boston Univ. School of Medicine, Boston). Am. J. Physiol. 186, 549-53(1956) Sept.

11656
EFFECT OF X-RAYS ON THE SURVIVAL OF BACTERIA AND YEAST. II. RELATION OF CELL CONCENTRATION AND ENDOGENOUS RESPIRATION TO SENSITIVITY. Shirley E. Gunter and Henry I. Kohn (Univ. of California School of Medicine, San Francisco). J. Bacteriol. 72, 422-8(1956) Sept.

11657
DEOXYRIBONUCLEIC ACID AND PHOSPHOLIPIDE METABOLISM IN REGENERATING LIVER AND THE EFFECT OF X-RADIATION. Christine D. Jardetzky, Cyrus P. Barnum, and Halvor Vermund (Univ. of Minnesota, Minneapolis). J. Biol. Chem. 222, 421-33 (1956) Sept.

11658
STUDIES OF RADIOACTIVE PHOSPHORUS (P^{32}) APPLIED TO HUMAN SKIN. I. ERYTHEMA AND AUTORADIOGRAPHIC FINDINGS FOLLOWING APPLICATIONS IN VARIOUS FORMS. Victor H. Witten, Earle W. Brauer, Robert Loevinger, and Vera Holmstrom (New York Univ. Post-Graduate Medical School and New York Univ. Hospital). J. Invest. Dermatol. 26, 437-47(1956) June.

Experiments were carried out in the attempt to ascertain if any differences in clinical biologic effects, as judged by erythema, would result from the topical application of radioactive P^{32} to human skin in vivo as an aqueous solution, in the form of blotting paper discs and in specially constructed sealed plaques. In one series of experiments the penetration and localization of P^{32} applied in aqueous solution and as blotting paper discs was demonstrated by autoradiography of tissue sections prepared from biopsy specimens. The details of these experiments are given. When P^{32} solution is applied to the surface of the skin by direct pipetting or in the form of a blotting paper disc there is no correlation between the erythematous response which is observed and the amount of P^{32} found on the surface of the skin or within the tissues as demonstrated by autoradiography. When P^{32} is applied to the surface of the skin simultaneously as an aqueous solution, in the form of a blotting paper disc and in a sealed plaque, no regular difference in biologic effect, as judged by erythema, is observed between the three methods. The results of these

studies indicate that P^{32} produces essentially the same erythema when applied to human skin whether it acts from the surface or following penetration into the tissues. These findings with a pure beta emitter are compared with the findings of similar studies previously done with thorium X (primarily an alpha emitter) in which it was shown that the penetration of the thorium X into the tissue definitely enhances the erythematous response. (auth)

11659
REPORT OF SURGICAL REPAIR IN THE FIRST GROUP OF ATOMIC RADIATION INJURIES. James Barrett Brown and Minot P. Fryer. Surg. Gynecol. Obstet. 103, 1-4(1956) July.

The care and surgical repair is described of skin lesions induced by exposure to atomic radiations. (C.H.)

11660
NEUTRON AND X-RAY EXPERIMENTS IN WHEAT AND A REVISION OF THE SPELTOID PROBLEM. James Mac Key. Lund, Berlingska Boktryckeriet, 1954. 200p.

Results are presented from a study of the observable mutations in 6x-wheat and, for comparison, 2x-barley, where dormant seeds were treated with successively increasing doses of x-rays and fast neutrons. (254 references.) (C.H.)

RADIATION HAZARDS AND PROTECTION

11661 ANL-5596
Argonne National Lab., Lemont, Ill.
RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JANUARY THROUGH JUNE 1956. July 1956. 64p. Contract W-31-109-eng-38. $0.40(OTS).

Data are presented from studies on the radiation chemistry of xylene and the absorbance properties of scintillation solutions employing irradiated xylene as a solvent; the radiometric determination of low levels of expired radon; the solvent extraction of small amounts of Th^{228} from bone samples; factors affecting the counting efficiency of a scintillation detector designed for radon counting; calculations pertaining to determination of the Ra produced in vivo from a Th parent; measurements of γ rays in vivo; microradiographic analysis of the crystal structure of bone; the performance of a halogen sensitive positive ion emitter in studies of gaseous diffusion problems; the separation and radiometric determination of Cs^{137} in urine; pulsed operation of the 250-kev Cockcroft-Walton accelerator; the feasibility of using a gridded ion chamber for Ra and RdTh analysis; the performance of a oscilloscope for determinations of drift velocity of electrons; development of a method for measuring atmospheric diffusion by taking multiple exposures of a smoke plume using two cameras for separate views; the development of automatic data processing systems for the analysis of meteorological data; and modifications for the improvement of meteorological instruments. (For preceding period see ANL-5518.) (C.H.)

11662 HW-43781
Hanford Atomic Products Operation, Richland, Wash.
RESEARCH, DEVELOPMENT, AND EXPERIENCE RESOURCES IN RADIOLOGICAL SCIENCES AT HANFORD ATOMIC PRODUCTS OPERATION. C. K. Irwin, comp. June 15, 1956. 28p. Contract W-31-109-Eng-52. $0.25 (OTS).

The Radiological Sciences Department at Hanford is equipped to supply services to other AEC contractors, governmental agencies, or private organizations who may require research and development assistance or consultation with men experienced in the field of radiological sciences. The services available are discussed in detail. A summary is included of available personnel, facilities and equipment. (C.H.)

11663 USNRDL-TR-104
Naval Radiological Defense Lab., San Francisco.
FURTHER STUDIES ON THE MODIFICATION OF RADIATION INJURY IN MICE BY ISOLOGUS AND HETEROLOGOUS BONE MARROW. L. J. Cole, J. G. Habermeyer, and P. C. Newell. Aug. 6, 1956. 30p. Project NM-006-015.04.

11664 USNRDL-TR-107
Naval Radiological Defense Lab., San Francisco.
INFLUENCE OF SPLEEN HOMOGENATE INJECTION ON POST-IRRADIATION INFECTION. M. S. Silverman, V. Greenman, M. Ellis, and L. J. Cole. Aug. 14, 1956. 14p. Project NM 006-015-04.

Injections of isologous spleen following whole-body x irradiation in the LD_{100} range of LAf_1 mice resulted in a decreased incidence of post-irradiation infection and an increased survival of the animals. The data presented provide further evidence of the critical role of infection in the death of mice following severe radiation injury to the hematopoietic tissue. If an accelerated repair of this injury is accomplished, a more rapid recovery of the anti-microbial defenses of the animal results. This leads to increased survival following irradiation. (auth)

11665
RADIATION DOSAGE FROM BREATHING RADON AND ITS DAUGHTER PRODUCTS. Jacob Shapiro (General Dynamics Corp., Groton, Conn.). Arch. Ind. Health 14, 169-77(1956) Aug.

11666
RECOVERY FROM IRRADIATION FOLLOWING THE ADMINISTRATION OF CULTURED TISSUES. Carol L. Miller (Atomic Energy Research Establishment, Harwell, Berks, England). Nature 178, 142(1956) July 21.

Liver and spleen tissue from infant mice may be stored and preserved for treatment of x-ray lethal doses. Spleen fragments are stored with glycerol at 79°C and cultured in rabbit serum and glucose. Embryonic liver fragments may be cultured with rabbit serum and glucose. The cultured embryonic liver is active for four days although two days have been taken as a standard culture time. (F.S.)

11667
BIOLOGICAL HAZARDS OF NUCLEAR AND OTHER RADIATIONS. C. Auerbach. Nature 178, 453-4(1956) Sept. 1.

A comparison of autoritative digests by Great Britain and the United States was discussed. Both reports show that the present dangers arise much more from excessive use of x rays than from bomb fall-out or from atomic energy establishments. (J.H.M.)

11668
MORTALITY AND SKIN TRANSPLANTABILITY IN X-IRRADIATED MICE RECEIVING ISOLOGOUS, HOMOLOGOUS OR HETEROLOGOUS BONE MARROW. J. J. Trentin (Baylor Univ. Coll. of Medicine and Univ. of Texas Dental Branch, Houston). Proc. Soc. Exptl. Biol. Med. 92, 688-93(1956) Aug.-Sept.

The degree and duration of protection afforded by isologous, homologous, and heterologous sources of bone marrow administered after lethal doses of x-irradiation in mice was directly proportional to the closeness of genetic relationship of the marrow donor to the irradiated mice. Uninjected controls were all dead by the 12th day. Mouse marrow from the same strain or from an F_1 hybrid of the irradiated strain, or from a foreign strain, all gave excellent and essentially equal protection as late as 21 days post-irradiation. While mice receiving marrow from the same strain remained well protected beyond 100 days, those receiving marrow from a foreign strain showed considerable late mortality between the 21st and 60th days. Mortality in mice receiving F_1 hybrid marrow was intermediate at 60 days. Guinea pig and rabbit marrow elicited

a very low degree and duration of protection. Rat marrow permitted 55% of the irradiated mice to survive beyond the longest survival of the untreated controls. The duration of protection however was short, only 6% at 60 days. Irradiated mice protected with marrow from an F_1 hybrid of the irradiated strain showed a high degree and long duration of tolerance of skin homografts from the F_1 hybrid or from the other parent strain. Irradiated mice protected with foreign strain mouse marrow showed a high degree and long duration of tolerance for skin homografts from the same foreign strain. Irradiated mice protected with marrow from the same strain did not tolerate skin homografts from a foreign strain or from an F_1 hybrid. (auth)

11669
HAZARDS OF RADIOACTIVE MATERIALS. Paul E. Smith, Jr. pp.82-8 in "Transactions of the Nineteenth Annual Meeting of the Industrial Hygiene Foundation of America, Held at Mellon Institute, Pittsburgh, Penna., November 17-18, 1954". Transactions Bulletin No. 28. Pittsburgh, Industrial Hygiene Foundation of America, 1955. 241p.

Some of the more common industrial uses of radioactive materials are discussed. Hazards and protective measures for handling radioisotopes are discussed. (C.H.)

RADIOGRAPHY

11670
THE YEAR BOOK OF RADIOLOGY (1955–1956 SERIES): RADIOLOGIC DIAGNOSIS. John Floyd Holt and Fred Jenner Hodges, eds. RADIATION THERAPY. Harold W. Jacox and Morton M. Kligerman, eds. Chicago, Year Book Publishers, Inc., 1955. 413p.

Highlights of the year's significant publications in diagnostic and therapeutic radiology are reviewed. (C.H.)

RADIOTHERAPY

11671
THE RELATIONSHIP BETWEEN I^{131} METABOLISM, TUMOR GROWTH, AND REGRESSION. Kenneth G. Scott and Marie B. Daniels (Univ. of California School of Medicine, San Francisco). Cancer Research 16, 784-7(1956) Sept.

11672
THE UTILIZATION OF EUROPIUM 152-154 IN A CERVICAL CARCINOMA APPLICATOR. I. Meschan and T. H. Oddie (Bowman Gray School of Medicine, Winston-Salem, N. C.) and Marshall Brucer (Oak Ridge Inst. of Nuclear Studies, Tenn.). Radiology 67, 422-3(1956) Sept.

The advantages are discussed of substituting $Eu^{152-154}$, with a half-life of 12.4 years, for Co^{60}, with a half-life of 5.3 years, as a γ source in an applicator for treating carcinoma of the cervix. (C.H.)

11673
HAZARDS OF RADIOACTIVE MATERIALS. Allan J. Fleming. pp.90-1 in "Transactions of the Nineteenth Annual Metting of the Industrial Hygiene Foundation of America, Held at Mellon Institute, Pittsburgh, Penna., November 17-18, 1954". Transactions Bulletin No. 28. Pittsburgh, Industrial Hygiene Foundation of America, 1955. 241p.

Uses of radioactive isotopes in medical research and therapeutics are briefly summarized. (C.H.)

Refer also to abstract 11959.

TOXICOLOGY STUDIES

11674
RENAL CLEARANCE OF FLUORIDE. Phillip S. Chen, Jr., Frank A. Smith, Dwight E. Gardner, James A. O'Brien, and Harold C. Hodge (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Proc. Soc. Exptl. Biol. Med. 92, 879-83(1956) Aug.-Sept.

TRACER APPLICATIONS

11675
EXCRETION OF RADIOACTIVE ZINC (Zn^{65}) IN BILE, PANCREATIC AND DUODENAL SECRETIONS OF THE DOG. Martin Birnstingl, Bernard Stone, and Victor Richards (Stanford Univ. Hospitals, San Francisco). Am. J. Physiol. 186, 377-9(1956) Sept.

11676
ACETATE METABOLISM: EFFECT OF THE ROUTE OF TRACER DOSAGE. Wallace R. Williams and J. T. Van Bruggen (Univ. of Oregon Medical School, Portland). Am. J. Physiol. 186, 393-6(1956) Sept.

11677
NATURE OF THE INHIBITION BY THIOCYANATE OF THE IODIDE CONCENTRATING MECHANISM OF THE THYROID GLAND. Seymour H. Wollman (National Cancer Inst., Bethesda, Md.). Am. J. Physiol. 186, 453-9(1956) Sept.

11678
A STUDY OF THE PREPARATION, LOCALIZATION, AND EFFECTS OF ANTITUMOR ANTIBODIES LABELED WITH I^{131}. R. W. Wissler, P. A. Barker, M. H. Flax, M. F. LaVia, and D. W. Talmage (Univ. of Chicago). Cancer Research 16, 761-73(1956) Sept.

11679
UPTAKE OF RADIOACTIVE PHOSPHORUS IN EXPERIMENTAL TUMORS. I. COMPARISON OF RADIOACTIVITY IN NEOPLASTIC AND NORMAL OCULAR TISSUE. Charles I. Thomas, Mary Sue Bovington, and Jack S. Krohmer (Western Reserve Univ. School of Medicine, Cleveland, Ohio). Cancer Research 16, 796-803(1956) Sept.

11680
INHIBITION OF THYROIDAL RADIOIODINE UPTAKE FOLLOWING INTRAVENOUS ADMINISTRATION OF THYROXINE TO NORMAL AND TO HYPOPHYSECTOMIZED ADULT SUBJECTS. Norman E. Sharrer and Samuel P. Asper (Johns Hopkins Univ., Baltimore). J. Clin. Endocrinol. and Metabolism 16, 1311-25(1956) Oct.

11681
STUDIES ON THE SALIVARY SECRETION OF IODIDE. Zeth Gabrielsen and Arthur L. Kretchmar (Oak Ridge Inst. of Nuclear Studies, Tenn.). J. Clin. Endocrinol. and Metabolism 16, 1347-53(1956) Oct.

11682
UPTAKE AND TURNOVER OF CALCIUM-45 BY THE GUPPY. Harold L. Rosenthal (Rochester General Hospital, N. Y.). Science 124, 571-4(1956) Sept. 28.

11683
STRONTIUM–CALCIUM DISCRIMINATION FACTORS IN THE RAT. C. L. Comar, R. H. Wasserman, and M. M. Nold (Oak Ridge Inst. of Nuclear Studies, Tenn.). Proc. Soc. Exptl. Biol. Med. 92, 859-63(1956) Aug.-Sept.

11684
CHEMISTRY, BIOCHEMISTRY, AND ISOTOPIC TRACER TECHNIQUE. Lectures, Monographs and Reports, 1955—No. 2. London, Royal Inst. of Chemistry, 1955. 59p.

The applications of tracer techniques to chemistry and biochemistry, especially metabolism and biosynthesis studies, are reviewed and discussed. (T.R.H.)

CHEMISTRY

11685 AECU-3332
Internuclear Co., Clayton, Mo.
DATA ON INDIUM SULFATE. R. J. Jaffe. July 13, 1956. 19p. A-1 Project. (IC-RJJ-56-3). $3.30(ph OTS); $2.40(mf OTS).

At room temperature, about 60 wt. % of $In_2(SO_4)_3$ or 1100 gms per liter dissolves in H_2O. A low pH must be maintained to keep In salts in solution. $In_2(SO_4)_3$ hydrolyzes when it dissolves in H_2O, and a pH of about 1.0 occurs at the maximum solubility. A pH condition higher than the normal pH will cause floculation of a hydrous $In(OH)_3$. Lowering the pH redissolves the floc. There are no data on the corrosion behavior of $In_2(SO_4)_3$ solutions. (auth)

11686 CCC-1024-TR-199
Callery Chemical Co., Penna.
REACTIONS OF TETRABORANE WITH ETHERS. W. V. Hough, M. D. Ford, and L. J. Edwards—P. M. Maginnity, ed. Sept. 5, 1956. 12p.

An unstable complex, ethyl ether-triborane, was isolated from the reaction between ethyl ether and tetraborane at room temperature. The reaction can best be represented by the equation $2B_4H_{10} + 2(C_2H_5)_2O \rightarrow 2(C_2H_5)_2O \cdot B_3H_7 + B_2H_6$. Further reaction occurred giving a net result $5B_4H_{10} \xrightarrow{(C_2H_5)_2O} 2B_5H_9 + 5B_2H_6 + H_2$. Tetrahydrofuran and tetraborane reacted at room temperature to yield tetrahydrofuran-triborane quantitatively in a few minutes according to the equation $2B_4H_{10} + C_4H_8O \rightarrow 2C_4H_8O \cdot B_3H_7 + B_2H_6$. If an excess of tetraborane was involved, pentaborane was obtained by the equation $5B_4H_{10} \xrightarrow{C_4H_8O \cdot B_3H_7} 5B_2H_6 + 2B_5H_9 + H_2$. A preliminary study of the effects of temperature, concentration, and time upon the conversion of tetraborane to pentaborane was made. (auth)

11687 CCC-1024-TR-200
Callery Chemical Co., Penna.
CARBONYLATION OF BORATES. R. K. Pearson, J. C. Renforth, and L. J. Edwards—L. S. Stone, ed. Sept. 12, 1956. 8p.

The ability of CO to liberate methyl borate from sodium borates in methanol, with sodium formate as a by-product, was demonstrated in a brief series of screening experiments. (auth)

11688 CCC-1024-TR-202
Iowa State Coll., Ames.
MIGRATION OF METHYL GROUPS IN TRIMETHYLBORANE. R. Schaeffer and B. Tollin. Sept. 21, 1956. 23p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

Evidence from mass spectrometric analyses indicates that under certain conditions methyl groups may migrate between B atoms in trimethylborane. Such exchange did not occur readily in gaseous mixtures, and in liquid mixtures only after prolonged standing (7 hours at −80°C followed by 10 hours at −135°C). The temperature may be the significant factor in such cases, however. In the light of this finding, the formation of a dimeric species of trimethylborane has been treated as a possible means whereby the migration of the methyl groups is facilitated. The mass spectrum of trimethylborane was determined, and attempts were made to analyze this spectrum in terms of the various ionic species present. (auth)

11689 NAA-SR-1544
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
GENERAL CHEMISTRY QUARTERLY PROGRESS REPORT [FOR] JULY–SEPTEMBER 1955. E. Motte, D. Bareis, S. Yosim, and L. Silverman, eds. May 15, 1956. Decl. July 23, 1956. 20p. Contract AT-11-1-GEN-8. $0.30(OTS).

The thermal and radiation stabilities of a mixture of polyphenyls (70 wt. % terphenyl and 30 wt. % diphenyl), under reactor conditions were investigated. Analytical methods for the determination of Ba and Sn in Zr, H_2 in He, and Zr in Th are briefly mentioned. (For preceding period see NAA-SR-1476.) (C.W.H.)

11690 NP-6100
Chicago, Univ.
HYDRIDES AND BOROHYDRIDES OF LIGHT WEIGHT ELEMENTS AND RELATED COMPOUNDS. Annual Technical Report for the Period August 1, 1956 to July 31, 1956. H. I. Schlesinger. Aug. 1, 1956. 50p. Project NR 356-255. Contract N6ori-02010.

During the year the work on the conversion of hydrazine salts to the anhydrous, free bases and that on the behavior of diborane and related compounds toward hydrazine and methyl hydrazines was carried far enough for later publication, although some additional studies on the latter problem now seem desirable. Diboron tetrafluoride was prepared for the first time and was studied in sufficient detail for early publication. Much time was devoted to the continued study of the reaction of diboron tetrachloride and of diboron tetrafluoride toward unsaturated hydrocarbons and some of their halogen derivatives, but considerable work on this topic is planned for the coming year. A number of minor, exploratory experiments were carried out as will be briefly described in the body of the report. (auth)

11691 ORNL-2159
Oak Ridge National Lab., Tenn.
CHEMISTRY DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1956. Oct. 11, 1956. 103p. Contract W-7405-eng-26. $0.55(OTS).

Nuclear Chemistry. Measurement of the neutron capture cross section of U^{236} is reported, and L/K electron-capture ratios for Ce^{139} are determined by 3 methods. A continuation of the studies on short-lived fission products is reported. Isolation and Chemical Properties of Synthetic Elements. Investigations into the chemistry of Tc and Re are continued with work on thermodynamic properties of K_2ReCl_6, and on solvent extraction of Tc^{7+}. Radiation Chemistry. The effect of gamma radiation on the heterogeneous catalysis of the H_2-D_2 exchange reaction and information on amorphous ice are reported. Investigation of electron existence in a stable bound state in H_2O, CH_3OH, and C_2H_5OH, is reported and all-platinum equipment for high-temperature, high-pressure studies described. Several radiation induced reactions are discussed along with the effect of radiation upon the $H_2-C_2H_5OH$ exchange reaction. Organic Chemistry. Publications of the Chemistry Division are presented. Chemistry of Aqueous Systems. Ion exchange separations and fundamental studies on ion exchange resins and adsorption on inorganic materials are discussed. Other studies reported include hydrolysis and concentrated polymer solutions of Th^{4+}, ultracentrifugation of inorganic solutions, solubility of Ag_2SO_4 in various electrolyte media, preparation of a PbO_2 electrode for high temperatures, measurement of solubilities with packed columns, stabilization of ThO_2 sols, isopiestic equipment for high-temperature thermodynamic studies, concentrated salt solutions for reactor fuel media or heat exchanger fluids, and dilute solutions in the system $UO_2SO_4-CuSO_4-NiSO_4-H_2SO_4-H_2O$. Chemistry of Corrosion. Passivation and inhibition, electrode potentials under radiation, and potentiostatic studies on stainless steel electrodes in H_2SO_4 solutions, are discussed. Nonaqueous Systems at High Temperatures. Investigations in cryos-

copy and high-temperature calorimetry and vapor pressures over salt mixtures are reported. The results of studies on properties of fused-salt and liquid metal-salt solutions are given along with an x-ray-diffraction study of molten CsI. Chemical Physics. Gas yields from irradiated acids, pure quadrupole spectroscopy, and paramagnetic resonance are topics covered. A single-crystal neutron-diffraction study of AlO(OH) is included. (For preceding period see ORNL-2046.) (T.R.H.)

11692 PA-TR-2262

Picatinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

AN INTRODUCTION TO THE BEHAVIOR OF CERTAIN MECHANICAL MODELS USED FOR DESCRIBING VISCOELASTIC BEHAVIOR. Stephen Strella. Feb. 1956. 42p. DA Project 559-01-004.

A simple rigorous mathematical exposition of basic characteristics of commonly used models is given which enables one to profitably follow discussions on the mechanical behavior of polymers. (F.S.)

11693 USNRDL-TR-102

Naval Radiological Defense Lab., San Francisco.

THE MECHANISMS OF IGNITION OF CELLULOSIC MATERIALS BY INTENSE THERMAL RADIATION. A Report Based on a Search of the Subject Literature. S. Martin. Feb. 10, 1956. 49p. Project NS 081-001. (AFSWP-799).

Existing information about the processes occurring in a cellulosic solid undergoing pyrolysis is summarized with attention directed toward possible changes in reaction mechanism with increased heating rates. The significance of such mechanism changes in regard to the ignition event is discussed. The properties and rate behavior characteristics of gas phase oxidation reactions are presented along with some examples of analytical expressions describing the temperature-concentration profiles in the system. The combination of heat and mass transfer with classical reaction kinetics is suggested as a powerful tool for uncovering the fundamental processes involved in the ignition of cellulose by intense radiant energy. (auth)

11694 WADC-TR-55-26(Pt. IV)

Rutgers Univ., New Brunswick, N. J.

RESEARCH ON BORON POLYMERS. [Final Report for] December 1955 through June 1956. William L. Ruigh, A. D. Olin, N. D. Steinberg, P. A. van der Meulen. June 1956. 35p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Contract AF33(616)-2057.

Tri-B-β-chloroborazole has been prepared from β-chlorovinylboron dichloride and ammonia. It is unstable and in the presence of polar solvents forms either cyclic or long chain polymers. Large samples of 100 grams or more of tri-B-b-butylborazole, hexabutylborazole, and tri-N-Methyl-tri-B-n-butylborazole were prepared for evaluation. (auth)

11695 WIS-OOR-13

Wisconsin. Univ., Madison. Naval Research Lab.

PROPERTIES OF GASEOUS AND LIQUID MIXTURES. Walter K. Tang. Aug. 9, 1956. 212p. DA Project No. 599-01-004. Contract DA-11-022-CRD-994.

These assembled tables of P-V-T data of gaseous and liquid mixtures were collected from the published literature (1933-1954) for 41 binary and 2 ternary systems, representing 14,000 points from 218 different compositions and 23 compounds. The purpose of this assembly is to make such data readily available for establishing subsequently the pseudo-reduced properties and generalized correlations of mixtures. (auth)

11696 AERE-Lib/Trans-767

POLAROGRAPHIC DETERMINATION OF THE DECOMPOSITION POTENTIALS OF METALLIC CHLORIDES IN FUSED $AlCl_3$–NaCl AS SOLVENT. Yu. K. Delimarskii, E. M. Skobsts, and L. S. Berenblyum. Translated by V. Beak from Zhur. Fiz. Khim. 22, 1108-15(1948). 11p.

The decomposition potentials of various metallic chlorides fused in NaCl are determined by recording the I-V curve on a polarograph. The results are compared with those of other investigators and the method is evaluated. (T.R.H.)

11697

MASS SPECTROMETRIC STUDY OF GASEOUS SPECIES IN THE B–B_2O_3 SYSTEM. Mark G. Inghram, Richard F. Porter, and William A. Chupka (Univ. of Chicago and Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 25, 498-501(1956) Sept.

A combination of Knudsen effusion and mass spectrometric techniques have been employed in studying the species existing in the vapor in thermodynamic equilibrium with a condensed mixture of boron and boric oxide in the temperature range 1300°K to 1500°K. Positive ions were produced by electron bombardment of vapor effusing from the Knudsen cell and were analyzed mass spectrometrically. Ion currents of B^+, BO^+, $B_2O_2^+$, and $B_2O_3^+$ were observed. The mixture, B + B_2O_3, was shown to vaporize mainly as the gaseous molecule, B_2O_2. The heat of vaporization of $B_2O_2(g)$ from the condensed phase is $\Delta H_{1400}^0 = 94 \pm 8$ kcal/mole. The ΔH_0^0 for the reaction $\frac{2}{3}B(s) + \frac{2}{3}B_2O_3(g) \rightarrow B_2O_2(g)$ is found to be 35.7 ± 3.5 kcal. The BO^+ and B^+ ions observed were found to be formed mainly in processes of dissociative ionization. The concentration of BO(g) in the vapor is at least an order of magnitude lower than that of $B_2O_2(g)$ showing the dimerization energy is greater than 99.6 kcal. Results obtained with pure B_2O_3 liquid in the Knudsen cell agree with earlier published work. (auth)

11698

CALORIMETRIC DETERMINATION OF HEATS OF FORMATION OF TITANIUM CHLORIDES. Walter F. Krieve, Stephen P. Vango, and David M. Mason (California Inst. of Tech., Pasadena). J. Chem. Phys. 25, 519-23(1956) Sept.

The heats of formation of $TiCl_4(l)$, $TiCl_3(s)$, and $TiCl_2(s)$ were determined by chlorinating Ti, $TiCl_3(s)$, and $TiCl_2(s)$, respectively, in a nickel-bomb calorimeter to give $TiCl_4(l)$. The directly measured heat of chlorination at 25° of Ti is -190.0 ± 0.4, of $TiCl_3(s)$ is 20.9 ± 0.1, and of $TiCl_2(s)$ is 69.9 ± 0.8 kcal/mole^{-1}. Relative to a value for the heat of formation of $TiCl_4(l)$ of -190.0 ± 0.4, the corresponding values for the heats of formation of $TiCl_3(s)$ and $TiCl_2(s)$ are -169.1 ± 0.4 and -120.1 ± 0.8 kcal/mole^{-1}, respectively. (auth)

11699

MEASUREMENT OF EQUILIBRIUM OF THE REACTION: $TiCl_3(s) + HCl(g) \rightleftharpoons TiCl_4(g) + \frac{1}{2}H_2(g)$. Walter F. Krieve and David M. Mason (California Inst. of Tech., Pasadena). J. Chem. Phys. 25, 524-5(1956) Sept.

Equilibrium in the $TiCl_3(s)$–HCl(g) system was studied in the temperature range 350 to 475°C by measuring the total pressure in an isochoric vessel. The equilibrium data for the above reaction in this temperature range are given by $\log_{10}K(\text{atmos}) = (-2.27 \times 10^3/T) + 1.82$. From these data, the enthalpy and entropy of reaction at the average temperature of about 690°K are 10.4 ± 0.4 kcal and 17.5 ± 0.5 cal/deg, respectively. From an estimated value for the ΔC_p of reaction, the enthalpy and entropy of reaction at 25°C are estimated to be 12.7 ± 1.0 kcal and 22.5 ± 2.0 cal/deg, respectively. The difference between the enthalpies of formation of $TiCl_3(s)$ and $TiCl_4(l)$ is 19.0 ± 1.0 kcal/mole^{-1} at 25°C. The equilibrium is shifted toward $TiCl_4(g)$ and $H_2(g)$ with increase in temperature, and 25°C the reduction of $TiCl_4(g)$ by $H_2(g)$ to give $TiCl_3(s)$ is nearly complete, although the rate of the reaction is very low. (auth)

11700

DISPROPORTIONATION AND VAPOR PRESSURE OF $TiCl_2$. Milton Farber and A. J. Darnell (California Inst. of Tech., Pasadena). J. Chem. Phys. 25, 526-30(1956) Sept.

The disproportionation and sublimation of $TiCl_2(s)$ have been investigated by means of a Mo effusion cell in a temperature range of 800 to 900°K. Heats and entropies of reaction at the average temperature of 850°K were obtained for three reactions: (1) $2TiCl_2(s) = TiCl_4(g) + Ti$; $\Delta H = 49.5 \pm 1$ kcal, $\Delta S = 32.2 \pm 1$ cal/°C. (2) $3TiCl_2(s) = 2TiCl_3(g) + Ti$; $\Delta H = 87.2 \pm 1$ kcal, $\Delta S = 62.1 \pm 1$ cal/°C. (3) $TiCl_2(s) = TiCl_2(g)$; $\Delta H = 46.8 \pm 1$ kcal/mole, $\Delta S = 30.7 \pm$ cal/°C/mole. X-ray-diffraction patterns of mixtures of $TiCl_2$ and $TiCl_3$ gave no evidence of any appreciable solid solution. (auth)

11701

THERMODYNAMIC PROPERTIES OF THE TITANIUM CHLORIDES. David Altman, Milton Farber, and David M. Mason (California Inst. of Tech., Pasadena). J. Chem. Phys. 25, 531-6(1956) Sept.

From a series of ten different experiments performed at this laboratory and from experiments reported elsewhere, the following thermodynamic properties have been obtained (ΔH_{f298} in kcal/mole and $S°_{298}$ in cal/°C/mole): $TiCl_4(l)$, $\Delta H_{f298} = -191.2$; $TiCl_4(g)$, $\Delta H_{f298} = -181.6$; $TiCl_3(s)$, $\Delta H_{f298} = -170.7$, $S°_{298} = 34.4$; $TiCl_3(g)$, $\Delta H_{f298} = -128.7$, $S°_{298} = 74.9$; $TiCl_2(s)$, $\Delta H_{f298} = -120.6$, $S°_{298} = 24.7$; $TiCl_2(g)$, $\Delta H_{f298} = -69.4$, $S°_{298} = 65.9$. A theoretical value for $S°_{298}$ of 56.1 was calculated for TiCl(g). Estimated values for the C_p of these compounds are also included. (auth)

11702

ELECTROCHEMICAL STUDIES ON POLONIUM. K. W. Bagnall and J. H. Freeman (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 2770-4(1956) Aug.

The potentials of the systems: Satd. calomel electrode|KCl(satd.)¦N-HNO_3¦Po^{IV} in N-HNO_3|Po on Au, Satd. calomel electrode|KCl(satd.)¦N-HCl¦Po^{IV} in N-HCl|Po on Au, and Satd. calomel electrode|KCl(satd.)¦N-HCl¦Po^{IV}, Po^{II} in N-HCl|Pt have been measured. The value obtained from the HNO_3 system ($E_0 = +0.76$ v) is in good agreement with that proposed by Haissinsky (+0.77 v) as a mean of the results obtained from tracer experiments and it is therefore concluded that the abridged form of the Nernst electrochemical equation is valid for polonium at concentrations greater than 10^{-7}M. (auth)

11703

SOME REACTIONS OF SCANDIUM. R. C. Vickery (Horizons Inc., Cleveland, Ohio). J. Chem. Soc., 3113-20 (1956) Aug.

The efficiency of several precipitation and extraction reactions of scandium has been investigated by radioactive-isotope techniques. The lack of a specific, quantitative precipitant is manifest. The solubilities of scandium hydroxide and oxalate, and the influence thereon of ammonium salts have been confirmed. The ineffectiveness of both precipitations for recovery of scandium is also confirmed. Precipitation of scandium as the potassium double fluoride or by disodium hydrogen phosphate is shown to give good recoveries of scandium but the suggested value of precipitation as pyrophosphate has not been fully confirmed. The solubility of potassium scandium sulfate has been determined radiometrically, and precipitation of scandium as organic basic found to be an inefficient mode of recovery. Precipitation of scandium as the ammonium double tartrate is quantitative at scandium concentrations greater than 50 mg. of Sc_2O_3 per ml. Precipitation of thorium as iodate successfully separates this element from scandium even in the presence of high concentrations of lanthanons. Solvent-extraction of scandium complexes has been briefly examined and extraction of the oxine chelate by chloroform or the acetylacetone chelate by ethyl acetate gives quantitative recovery in one operation. Such extractions are, however, less specific than that of scandium thiocyanate by ether which, in four extractions, gives 98.5% recovery. The application of the reactions studied to extraction of scandium from ores, and its purification, are briefly considered. (auth)

11704

THE ULTRACENTRIFUGAL BEHAVIOR OF SOME PROTEINS IN NON-AQUEOUS SOLVENTS. Henry L. Crespi, Robert A. Uphaus and J. J. Katz (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 60, 1190-2(1956) Sept.

Data obtained from ultracentrifugal and light scattering experiments indicate that proteins dissolved in trifluoroacetic acid and in trifluoroacetic acid–diethyl ether mixtures may be studied by methods standard for aqueous solutions. Ultracentrifugal analysis of several proteins in 3:1 trifluoroacetic acid–diethyl ether mixtures yielded the following experimental sedimentation constants: Silk fibroin, 2.25S; rattail tendon, 1.94S and 2.3S (two components); insulin, 1.80S. Bovine plasma albumin in a 4:1 trifluoroacetic acid–diethyl ether mixture gave an experimental sedimentation constant of 1.5S. Preliminary light scattering work indicated the following approximate molecular weights: silk fibroin, 60,000; rattail tendon collagen, 70,000; insulin, 6,000. (auth)

11705

ON THE STOKES-ROBINSON HYDRATION MODEL FOR SOLUTIONS. Donald G. Miller (Brookhaven National Lab., Upton, N. Y.). J. Phys. Chem. 60, 1296-9(1956) Sept.

The Stokes–Robinson hydration model is used to derive the following equation for molal activity coefficients $\log \gamma = \log f' - \log [1 - [(h - r)mM_1/1000]]$, which has no solvent activity term. f' is given by the Debye–Hückel expression for electrolytes and is equal to 1 for non-electrolytes. The equation is practical for computation, and fits the data for 2 non-electrolytes and 48 strong electrolytes as well as or better than the original of Stokes–Robinson. The hydration numbers are larger and are in agreement with those determined by various other methods. The choice of an ideality scale is briefly discussed. Further equations which account for both solvation and solute size are derived using a free-volume theory to fix the ideality scale. (auth)

11706

THE THERMODYNAMICS OF INDIUM SULFATE SOLUTIONS. M. H. Lietzke and R. W. Stoughton (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 4520-6(1956) Sept. 20.

For the cell: In, $In_2(SO_4)_3$(m), Ag_2SO_4 (sat.), Ag emf data are given in the concentration range 0.01 to 2.3 m and temperatures from 15 to 70°C. The log of the activity of $In_2(SO_4)_3$ is approximately proportional to the molality at a given temperature. Conductivity, solubility and emf data all strongly indicate considerable ionic association in $In_2(SO_4)_3$ solutions. (auth)

ANALYTICAL PROCEDURES

11707 AERE-C/R-1224

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A PRELIMINARY REPORT ON THE DETERMINATION OF SUBMICROGRAM QUANTITIES OF INDIVIDUAL RARE EARTHS BY RADIOACTIVATION USING ION EXCHANGE SEPARATION. F. W. Cornish. Sept. 4, 1953. Decl. Feb. 8, 1956. 47p.

The principles of radioactivation analysis as applied to the determination of individual rare earths are discussed together with problems due to transmutation. After separating the rare earth group from the irradiated sample, in the presence of added carriers, by precipitating as fluoride, oxalate and hydroxide, the individual earths are separated on a heated 100 cm column of fine Zeokarb 225. The ratio of chemical yields of any individual rare earth isolated from sample and standard is determined by a secondary radioactivation procedure, a feature which enables small quantities of relatively impure earths to be used as carrier. A complete general procedure is presented together with results of the analysis for individual earths in a sample of graphite and 'Specpure' Sm_2O_3. The largest amount of any single rare earth determined was 4×10^{-6} gm. and the smallest 2×10^{-8} gm. The ultimate sensitivity has not been approached. (auth)

11708 BM-RI-5256

Bureau of Mines.

SPECTROCHEMICAL ANALYSIS OF TITANIUM AND TITANIUM ALLOYS BY A POROUS CUP-SPARK METHOD. M. J. Peterson. Jan. 1956. 18p.

A spectrochemical procedure applicable to the determination of Fe, Mn, and Mg in Ti metal and to the determination of alloying constituents in three types of Ti alloys is presented. Acid solutions of samples and standards are excited with a spark-type discharge and porous-cup electrode arrangement. The method is particularly applicable for analyzing samples for which a self-electrode method cannot be used. (auth)

11709 CI/R-9

Gt. Brit. Ministry of Supply. Chemical Inspectorate, London.

THE MICRODETERMINATION OF URANIUM IN URINE BY THE FLUORIMETRIC METHOD. K. W. Holmes. Mar. 1951. 24p.

The microdetermination of U in urine, by the method of fusing the ignited residue from evaporated urine with fusion mixture containing alkali metal fluoride and then correlating with uranium content the intensity of the fluorescence excited in the solidified melt by ultra-violet light, is investigated with the aid of an electronic fluorimetric technique for the purpose of ascertaining optimum conditions for the possible variables, viz. fusion conditions, presence of impurities and contaminating substances, and volatility of U salts. A form of the method suitable for large scale routine examination of urine using an external U standard is described, as well as a more accurate modification employing an internal standard. (auth)

11710 MCC-1023-TR-208

Pennsylvania. Univ., Philadelphia.

ANALYTICAL STUDIES OF BORON COMPOUNDS (thesis). William J. Schuele. June 1956. 182p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

Of the methods investigated, the potentiometric and spectrophotometric methods gave consistently good results. Visual titrations gave consistently accurate values for hydrobromic acid but high values for boric acid. Conductometric titrations, which did not give as reproducible values as the other instrumental methods, did give approximately correct values and did not require the use of mannitol. To check these procedures further, several analysts were given aliquots of the test solution and the BBr_3 addition compounds and were asked to use the various methods. The largest disagreement was apparent in the visual titrations using only methyl red as indicator, the mixed indicator visual titration was only slightly better. Data obtained by the various analysts checked very well in both the spectrophotometric and the potentiometric titrations. These results are given. Conductometric titrations were not checked. While potentiometric and spectrophotometric methods are equally satisfactory, the spectrophotometric would appear to be more satisfactory for general use since it is not necessary to plot the curve to obtain the end point. Once the apparatus has been standardized the titration can be run to 50% transmission and the buret reading taken. The needle deflection is also much greater on the spectrophotometer than on the potentiometer making it easier to take readings. Spectrophotometric titrations are superior alternatives for visual titrations in which the end point is difficult to see. (auth)

11711 WAL-401/253

Watertown Arsenal Lab., Mass.

THE PHOTOMETRIC DETERMINATION OF COPPER IN TITANIUM. A. J. Frank, A. B. Goulston, and A. A. Deacutis. July 30, 1956. 31p. DA Project 593-08-021.

A neo-cuproine photometric procedure has been developed for the determination of Cu in Ti and Ti alloys The method is applicable to concentrations of 0.001 to 10 per cent Cu. The cuprous neo-cuproine complex is formed in a buffered citrate solution of pH 4 to 5 and is extracted into a mixed chloroform-alcohol solvent. The absorbance of the extract is measured at a wavelength of 452 mμ with reference to a reagent blank. For extracts containing more than 0.1 mg of Cu, the absorbance is measured with reference to a solution prepared with a known amount of Cu in addition to the reagent blank. The color-forming reaction is rapid. The absorbance remains constant for at least 96 hours. Beer's Law is obeyed at least to a concentration of 0.5 mg of copper in 25 ml of extract. Synthetic Cu–Ti solutions have been analyzed with an accuracy of one per cent. The analyses of solid samples by direct photometry and by the method of standard addition agree within three per cent. The precision of the method varies with the level of absorbance in a manner predictable on the basis of a constant uncertainty in reading the measuring instrument; precision, expressed as coefficient of variation, ranges from 0.5 to 3 per cent. (auth)

11712 AEC-tr-2577

QUANTITATIVE SPECTRAL ANALYSIS OF GASEOUS MIXTURES (abstract). S. E. Frish. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 18, 251(1954). 2p.

11713 AEC-tr-2579

APPLICATION OF SPECTRAL ANALYSIS TO THE INVESTIGATION OF THE PROCESSES OF ELECTRIC SPARK TREATMENT (Abstract). A. N. Lyulichev and L. S. Palatnik. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 18, 259(1954). 2p.

11714

ARGENTIC OXIDE AS A OXIDIMETRIC REAGENT. DETERMINATION OF MANGANESE, CERIUM, AND CHROMIUM. James J. Lingane and Donald G. Davis (Harvard Univ., Cambridge, Mass.). Anal. Chim. Acta 15, 201-6 (1956) Sept.

Argentic oxide, AgO, is commercially available (Merck) in pure form, and it serves advantageously as a very powerful oxidimetric reagent in acid media. On addition of a small excess of argentic oxide to cold solutions of manganous, cerous, or chromic ion in 2 to 5M nitric acid rapid and complete oxidation to permanganate, ceric, or dichromate ion takes place, and the excess argentic oxide dissolves. By simply diluting and warming the solution for a few minutes the excess Ag^{2+} is completely reduced by water, and the permanganate, ceric, or dichromate ion can then be titrated with standard ferrous solution in the usual way. Alternatively the titration with ferrous solu-

tion can be performed potentiometrically, which leads to an even simpler procedure because destruction of the excess Ag^{2+} by heating is unnecessary. The potentiometric titration curve exhibits two inflections, the first after reduction of the excess Ag^{2+} and the second after reduction of the permanganate, ceric, or dichromate ion. Results precise and accurate to ± 0.2% or better are easily obtained by either of these procedures, and they are more convenient and rapid than the classical titrimetric methods of determining these elements. The method has been applied with excellent results to the determination of manganese and chromium in aluminum and ferrous alloys, and to the determination of cerium in misch metal. (auth)

11715

DETERMINATION OF CARBON IN TITANIUM AND TITANIUM ALLOYS BY COMBUSTION. Maurice Codell, George Norwitz, and Edwin F. Schneider (Frankford Arsenal, Philadelphia). Anal. Chim. Acta 15, 218-22 (1956) Sept.

Considerable difficulty has been encountered in the past with the determination of carbon in titanium and titanium alloys by combustion. An accurate and rapid method is proposed in this paper. The method depends upon the fact that complete oxidation of carbon in titanium and titanium alloys is obtained if granulated lead is used as a flux at an initial temperature of 900°C. At this temperature the lead alloys with the titanium before oxidation to lead dioxide takes place. Sulfur dioxide and chlorine are eliminated by passing the gases through manganese dioxide and copper sulfate. Purification of oxygen used in the method is necessary. (auth)

11716

CHROMATOGRAPHY ON PAPER IMPREGNATED WITH ION EXCHANGE RESINS. PART II. THE SEPARATION OF SELENITE AND TELLURITE. M. Lederer and S. Kertes (Institut du Radium, Paris). Anal. Chim. Acta 15, 226-31 (1956) Sept.

The elution of tellurite and selenite on paper impregnated with Dowex-50 was examined with numerous acids. It was possible to relate the R_M value [$R_M = \log (I/R_F - I)$] with the pH of the eluting acid. This relationship can also be used for the determination of the charge of an ion as was shown with La^{+3} and Ni^{+2} ions. (auth)

11717

THE SPECTROPHOTOMETRIC DETERMINATION OF URANIUM BY MEANS OF THE AZIDE ION. H. I. Feinstein (U. S. Geological Survey, Washington, D. C.). Anal. Chim. Acta 15, 288-91(1956) Sept.

A method has been devised for the spectrophotometric determination of U by means of the azide ion. The method possesses several advantages over the various thiocyanate procedures. It has a slightly higher sensitivity, an aqueous medium is used, and the reaction product is more stable. Within the concentration limits tested, Beer's law is obeyed. (auth)

11718

POLAROGRAPHY OF TITANIUM IN STRONG MINERAL ACID MEDIA. James J. Lingane and John H. Kennedy (Harvard Univ., Cambridge, Mass.). Anal. Chim. Acta 15, 294-300(1956) Sept.

The polarographic characteristics of the titanic-titanous couple have been investigated in moderately concentrated aqueous solutions of hydrochloric, perchloric, sulfuric, and phosphoric acids. In 4 to 15M H_2SO_4 the reversible formal potential becomes more positive (oxidizing) than the potential of hydrogen ion reduction on Pt, and H_2SO_4 solutions can be employed advantageously for coulometric titrations with electrogenerated titanous ion using a Pt generator cathode. Phosphoric acid (1 to 15M) is the best of these media for practical polarographic determinations of titanium. The couple behaves perfectly reversibly, the cathodic and anodic waves are both excellently developed, and the half-wave potential (−0.25 to −0.09 V vs. S.C.E.) is such that determination of titanium in the presence of several of the elements with which it is commonly associated is possible. (auth)

11719

COULOMETRIC TITRATIONS WITH ELECTROLYTICALLY PLATED COPPER. John M. Dunham and Paul S. Farrington (Univ. of California, Los Angeles). Anal. Chem. 28, 1510-14(1956) Oct.

A method is described for using metallic Cu as a coulometric intermediate for reduction. Excess Cu is plated from a cuprous halide solution and the oxidant is added to the cell. After the reaction between the Cu and the oxidant is substantially complete, the Cu is stripped electrolytically. The I_2 or Cu^{2+} subsequently produced in the solution is detected amperometrically. Titrations of Cu^{2+} give an accuracy and precision within 0.6% with amounts from 0.16 to 3.2 mg. Modifying the technique of sample addition gives an accuracy within ±0.3% with 0.5 to 0.8 mg of Cu. With samples containing 0.4 to 0.8 mg of Fe^{3+}, accuracy is within 1%. (auth)

11720

THE ANTHRONE REAGENT. APPLICATION TO DETERMINATION OF THE HEPTULOSES. L. P. Zill (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 1577-80(1956) Oct.

Evidence is presented that implicates nitrate ion in the widely recognized instability of the anthrone reagent. Increased stability of the reagent is obtained by the use of low anthrone and acid concentrations and by the addition of thiourea, as proposed by Roe. The anthrone reaction may be applied to the quantitative determination of the heptuloses. (auth)

11721

3-HYDROXY-1,3-DIPHENYLTRIAZINE AS A REAGENT FOR COPPER(II), PALLADIUM(II), AND NICKEL(II) AND 3-HYDROXY-1-p-CHLOROPHENYL-3-PHENYLTRIAZINE FOR TITANIUM(IV). N. C. Sogani and S. C. Bhattacharyya (Government Coll., Ajmer, India and National Chemical Lab. of India, Poona). Anal. Chem. 28, 1616-18(1956) Oct.

Below pH 3, 3-hydroxy-1,3-diphenyltriazine is a highly selective reagent for the gravimetric estimation of Cu^{2+} and its separation from a large number of elements by direct weighing. It is superior to salicylaldoxime and α-benzoinoxime, and is useful for estimating Pd^{2+} in the presence of other members of the platinum group. At higher pH, it can be used for estimating Ni^{2+}. The chloro-substituted derivative, 3-hydroxy-1-p-chlorophenyl-3-phenyltriazine, forms a bright orange complex with Ti^{4+}, which is stable toward heat and can be used for estimating Ti^{4+}. (auth)

11722

POTASSIUM DETERMINATION WITH THE X-RAY SPECTROGRAPH. L. B. Gulbransen (Washington Univ., St. Louis). Anal. Chem. 28, 1632-4(1956) Oct.

A procedure has been developed using the x-ray spectrograph, in which potassium K radiation is used for the quantitative analysis of potash concentrates and tailings. Two working curves were established by a series of standard samples over the ranges 0.8 to 18.2% and 57.8 to 60.5% potassium oxide. X-ray spectrographic results are in agreement with chloroplatinate chemical analyses to within 0.4% potassium oxide. The total time for analysis, after the samples have been ground, is 6 minutes for tailings samples and 3 minutes for concentrates. (auth)

11723
A COMPARATIVE STUDY OF THREE RECENTLY DEVELOPED POLAROGRAPHS. D. J. Ferrett, G. W. C. Milner, H. I. Shalgosky, and L. J. Slee (Atomic Energy Research Establishment, Harwell, Berks, England and U. K. Atomic Energy Authority, Woolwich). Analyst 81, 506-12(1956) Sept.

The recently developed instruments include the cathode-ray polarograph, the square-wave polarograph and the Cambridge Univector polarograph unit. These instruments have been tested to obtain information on their relative merits and details of the results obtained are described. The tests included the following aspects: sensitivity for reversible and irreversible reductions at the dropping-mercury electrode, resolution for elements with half-wave potential values very close together, effects of the reduction of a major constituent at a more positive potential on the determination of a minor constituent, and speed of application, reproducibility and usefulness in analytical chemistry. (auth)

11724
THE POLAROGRAPHIC DETERMINATION OF URANIUM. H. I. Shalgosky (U. K. Atomic Energy Authority, Woolwich). Analyst 81, 512-17(1956) Sept.

A published method for the polarographic determination of U in an acid tartrate medium has been examined. Under the conditions that were adopted to achieve maximum sensitivity, the method has been shown to give low results. This is due to the effect of heating U in concentrated H_2SO_4 solution. Satisfactory results are obtained when $HClO_4$ is used for the chemical treatment and the dilute H_2SO_4 is added to the cold solution immediately before the polarographic determination. The sensitivity of the final method is shown to be similar to those of other polarographic methods for the determination of U and the factors that affect sensitivity are discussed. (auth)

11725
THE POLAROGRAPHIC DETERMINATION OF BORON. D. T. Lewis (Atomic Weapons Research Establishment, Aldermaston, Berks, England). Analyst 81, 531-6(1956) Sept.

No polarographic observations on B derivatives are recorded in the literature and it is generally understood that the simple boric acids do not yield polarograms when electrolyzed at the dropping-mercury electrode. It has been found that, in aqueous sulfite media and in presence of polyhydroxy derivatives, characteristic polarographic waves are produced if orthoboric acid is present in solution, concentrations of 0.0001 g of the acid per ml being readily discernible by this technique. In interpreting this phenomenon, it has been established that the polarographic waves are in reality due to the liberation of free sulfurous acid by the action of the relatively strong polyhydroxyboric acid complex on the sulfite additive. The formation of such polarograms is, however, definite qualitative evidence for the existence of boric acid in solution. (auth)

11726
RADIOCHEMICAL ANALYSIS BY GAMMA-RAY SPECTROMETRY. D. H. Peirson (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 7, 316-22(1956) Sept.

The analysis of samples of mixed radioactivity by γ-ray spectrometry is described. The method is illustrated by recordings from a two-crystal scintillation spectrometer of fission product spectra and by the radioactivation analysis of Al and of samples containing U and Th. (auth)

11727
ANALYSIS OF U AND Th MINERALS BY ALPHA SPECTRUM. U. Facchini, M. Forte, A. Malvicini, and T. Rossini (Laboratori CISE, Milan, Italy). Nucleonics 14, No. 9, 126, 128-31(1956) Sept.

The method consists of examination of the energy spectrum of α-particles from a very thin layer of mineral and adhesive on a metal disc. (T.R.H.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

11728
CRYSTALLOGRAPHIC DATA: DIAMMONIUM DIURANYL TRISULFATE PENTAHYDRATE, $(NH_4)_2(UO_2)_2(SO_4)_3.5H_2O$. Eugene Staritzky, Don T. Cromer, and D. I. Walker (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1634-5(1956) Oct. TETRASODIUM URANYL TRICARBONATE, $Na_4UO_2(CO_3)_3$. R. M. Douglass (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1635(1956) Oct. DIRUBIDIUM THORIUM HEXANITRATE, $Rb_2Th(NO_3)_6$. D. I. Walker, Don T. Cromer, and Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1635-6(1956) Oct.

DEUTERIUM AND DEUTERIUM COMPOUNDS

11729
CHEAPER WAYS TO MAKE D_2O. Paul Harteck (Rensselaer Polytechnic Inst., Troy, N. Y.). Nucleonics 14, No. 9, 97-9(1956) Sept.

General considerations involved in present D_2O production processes are reviewed. New methods are described and the economic feasibility discussed. The new methods involve distillation of liquid H_2, dual temperature H_2-H_2O exchange catalyzed by HCl radiation catalyzed exchange reactions, and radiation catalyzed production of H_2 from hydrocarbons. (T.R.H.)

FLUORINE AND FLUORINE COMPOUNDS

11730 K-532
Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.
STABILITY OF FREON-113 WITH FLUORINE. A. V. Faloon and J. D. Gibson. Dec. 16, 1949. 5p. Contract [W-7405-eng-26]. $0.10(OTS).

The stability of Freon-113 (1,1,2-trichloro-1,2,2-trifluoroethane) with fluorine was studied for the purpose of determining the feasibility of using it as a solvent in the direct fluorination of various compounds. Freon-113 was treated with a fluorine–nitrogen mixture at a temperature of 80°C, at atmospheric pressure, and a contact time of 3 minutes. Runs were made using 20, 40, and 60% fluorine. A copper cylinder filled with copper shot to give a free space of 55.0% was used as the reactor. Under the conditions investigated Freon-113 was found to be stable and can be used as a solvent for compounds undergoing treatment with elemental fluorine. (auth)

11731
THE HEATS OF FORMATION OF TETRAFLUOROETHYLENE, TETRAFLUOROMETHANE, AND 1,1-DIFLUOROETHYLENE. Constantine A. Neugebauer and John L. Margrave (Univ. of Wisconsin, Madison). J. Phys. Chem. 60, 1318-21(1956) Sept.

The standard heats of formation of gaseous tetrafluoroethylene and tetrafluoromethane have been determined by the hydrogenation and decomposition of tetrafluoroethylene in a bomb calorimeter. They are -151.7 ± 1.1 and -217.1 ± 1.2 kcal/mol, respectively. The heat of formation of gaseous 1,1-difluoroethylene was found to be -77.5 ± 0.8 kcal/mol from combustion experiments. (auth)

11732
OPTICAL PROPERTIES OF MAGNESIUM FLUORIDE FILMS. Nobuyoshi Morita (Scientific Research Inst., Tokyo). J. Phys. Soc. Japan 11, 975-80(1956) Sept.

Transmittance and reflectance of MgF_2 films deposited on optical glass and fused quartz are measured as functions of wavelength between 3500A and 6000A. Film deposited on fused quartz kept above 240°C shows remarkable scattering as compared with that of film deposited on optical glass under the same condition. This difference is explained by the affinity of film to substrate surface. Index of refraction is determined from wavelength of transmittance extremes and film thickness. The aging effect can not be observed. The causes of porosity of films are discussed. (auth)

11733
IONIZATION AND DISSOCIATION OF THE TRIFLUOROMETHYL HALIDES BY ELECTRON IMPACT. Vernon H. Dibeler, Robert M. Reese, and Fred L. Mohler. J. Research Natl. Bur. Standards 57, 113-18(1956) Aug.

Relative abundances and appearance potentials are reported for positive and negative ions observed in CF_4, CF_3Cl, CF_3Br, and CF_3I. The kinetic-energy distribution of positive ions is obtained by means of a "beam-deflection" technique. These data combined with that of recent thermochemical and spectroscopic studies permit a new calculation of the ionization potential of the CF_3 radical of 9.3 ± 0.2 electron volts, as well as estimates of fluorocarbon bond-dissociation energies. The energetics of probable dissociation processes are discussed. (auth)

GRAPHITE

11734 ANL-4369
Argonne National Lab., Lemont, Ill.
THERMAL ANNEALING OF NEUTRON-INDUCED DISCOMPOSITION IN ARTIFICIAL GRAPHITE. I. RATE OF HEALING EXPERIMENTS. T. J. Neubert. Nov. 18, 1949. Decl. Nov. 2, 1955. 37p. Contract W-31-109-eng 38. $0.30(OTS).

The distribution spectra for the thermal annealing of the disturbances produced in artificial graphite by fast neutron bombardment, suggest that interstitial disturbances which anneal out below 1000°C fall into two broad classes, with mean characteristic activation energies of 1.4 and 1.8 ev. The disturbances with characteristic energy 1.4 ev seem to be predominantly responsible for the electrical resistivity effects, while those with energy 1.8 ev seem to be the most important disturbances so far as elastic modulus effects are concerned. The secondary maxima in the distribution curves indicate the extent to which disturbances characteristic of the electrical resistivity changes affect the elastic modulus changes and vice versa. The precision of the experimental techniques, herein employed, is not adequate to permit a discussion of the Wigner effect in terms of any specific model. (auth)

11735 ANL-4477
Argonne National Lab., Lemont, Ill.
THERMAL ANNEALING OF NEUTRON INDUCED DISCOMPOSITION IN ARTIFICIAL GRAPHITE. II. ASYMPTOTIC ANNEALING EXPERIMENTS. T. J. Neubert. July 7, 1950. Decl. Nov. 2, 1955. 37p. Contract W-31-109-Eng-38.

An attempt has been made to discover the mechanism for the neutron induced discomposition of graphite by means of experiments in which irradiated specimens were heated for long periods at successively higher temperatures. The properties studied were the electrical resistivity and elastic modulus. Measurements were designed to show the effect of the amount of irradiation, the differences between the various types of pile graphite, the dependence upon the extrusion-produced crystallite orientation, and the dependence upon degree of graphitization and crystallite size. Extension of annealing experiments to 2000°C is described. It was found that whereas annealing at temperatures less than 1000°C caused the electrical resistivity effect and the elastic modulus effect to decrease, annealing in the region 1100 to 1330°C caused the electrical resistivity effect to increase. Annealings above 1350°C caused the electrical resistivity effect to decrease again until at ca. 2000°C the specimens exhibited their prebombardment resistivities. (auth)

11736 NAA-SR-1564
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
STORED ENERGY RELEASE IN GRAPHITE IRRADIATED AT LOW TEMPERATURES. S. B. Austerman. Oct. 1, 1956. 37p. Contract AT-11-1-GEN-8. $0.30(OTS).

Previous measurements of electrical and thermal resistivities and paramagnetic resonance have shown that graphite, when irradiated at or near liquid nitrogen temperatures, retains considerable damage which anneals out at below room temperatures. This report deals with the release of stored energy associated with this damage. To compute stored energy release, the relative specific heat of an irradiated specimen is compared with that of the specimen after annealing. Various types of artificial and natural graphite were irradiated in the liquid nitrogen facility of the Brookhaven Reactor. The stored energy release spectrum during steady temperature rise shows a peak at 215°K for graphite having large crystallities i.e., 3,000 A length and about 185°K for fine-crystallite graphite i.e., 300 A length. If it is assumed that the defects diffuse out of the crystallites on heating, the dependence of the annealing behavior on crystallite size can be accounted for with an activation energy of approximately 0.4 ev. The total stored energy releasable at below 275°K accumulates linearly with neutron exposure at a rate of 1.4 cal/gm per 10^{18} nvt. By estimating the number of responsible defects from neutron scattering data, the stored energy per atomic displacement is found to be in the order of 3 to 6 ev. An apparent increase in specific heat appears at low temperatures and can be qualitatively accounted for on the basis of isolated interstitial atoms behaving as Einstein oscillators. (auth)

11737
FREE ENERGY OF IMMERSION OF COMPRESSED POWDERS WITH DIFFERENT LIQUIDS. I. GRAPHITE POWDERS. R. G. Craig, J. J. Van Voorhis, and F. E. Bartell (Univ. of Michigan, Ann Arbor). J. Phys. Chem. 60, 1225-30(1956) Sept.

A method is described for the determination of the energy of wetting, i.e., the free energy of immersion, of finely divided solid material by a liquid. The method consists of obtaining complete vapor adsorption isotherms for a liquid adsorbate with an adsorbent comprised of a finely divided solid material which has been highly compressed into the form of plugs. These plugs are porous and possess capillary systems which give adsorption effects similar to those obtained with solid porous gels. The free energy of immersion can therefore be calculated from the adsorption data by application of the Gibbs adsorption equation as used by Dobay, Fu and Bartell in their study of silica gel. The free energies of immersion of each of a series of different graphite powders with the liquids toluene, carbon tetrachloride, n-heptane, cyclohexane and n-propyl alcohol were determined. The values obtained show that the free energy of immersion (expressed in free energy per unit area) is

independent of surface, i.e., of the particle size of the powdered material and of pressures used in compressing the plugs; it is dependent only on the nature of the surface of the powdered material. The surface areas, average pore volumes, average dry pore radii and porosities were determined for each of the graphite plugs used. The molecular cross sectional areas of the adsorbed molecules and the heats of adsorption of the first layer were determined for the various systems from the B.E.T. plots of the adsorption data. Standard free energies of adsorption were calculated in order to evaluate the relative strengths of the adsorptive bonds. (auth)

11738

CYCLOTRON RESONANCE EFFECTS IN GRAPHITE. J. K. Galt, W. A. Yager, and H. W. Dail, Jr. (Bell Telephone Labs., Inc., Murray Hill, N. J.). Phys. Rev. 103, 1586-7(1956) Sept. 1.

Cyclotron resonance effects were observed in crystalline flakes of graphite at 77, 4.2, 1.3, and 1.1°K at a frequency of 24,000 Mc/sec. Power absorption coefficients are plotted as a function of magnetic field. (B.J.H.)

11739

THE EFFECT OF THE MIXING OF π- AND σ-ORBITALS ON THE FERMI SURFACE IN THE l.c.a.o. MODEL FOR GRAPHITE. D. F. Johnston (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A237, 48-54(1956) Sept. 25.

The common energy of the two principal conduction bands in graphite along the triad axes in k-space is recalculated using an l.c.a.o. model based on sixteen orbitals per unit cell; four 2s and 2p (π and σ) orbitals centered on each of the four atomic sites in the unit cell. The results of a group-theoretical analysis are used to show that only 15 of the 136 elements of the resulting 16×16 secular determinant are required to compute the doubly degenerate root corresponding to the common energy of the two conduction bands on the triad axes. This energy is found to vary periodically along the triad axes with an amplitude of 0.013 ev. The corresponding overlap of the two conduction bands is about three times larger than the overlap found in the earlier calculation. The resulting correction to the energy surfaces near the triad axes is too small to affect the calculation of the Hall coefficient of graphite for room temperatures based on the earlier calculations, but it is significant at low temperatures. For temperatures below about 50°K and in the absence of electron donors or traps, the conduction region in k-space is confined to the top of the lower conduction band where the density of states per unit energy range is estimated to be $1.1 \times 10^{-2} \sqrt{(0.0135-\epsilon)}$ electronic states per atom per ev, and to the bottom of the upper conduction band where the density of states is found to be $5.8 \times 10^{-2} \sqrt{\epsilon}$. Formulae are given for the shape of the energy surfaces in these regions. (auth)

MOLECULAR STRUCTURE

11740

BORON ARRANGEMENT IN A B_9 HYDRIDE. Richard E. Dickerson, Peter J. Wheatley, Peter A. Howell, and William N. Lipscomb (Univ. of Minnesota, Minneapolis) and Riley Schaeffer (Iowa State Coll., Ames). J. Chem. Phys. 25, 606-7(1956) Sept.

The boron arrangement in a new boron hydride, believed to be B_9H_{15}, is established by x-ray-diffraction methods. (T.R.H.)

11741

THE RELATIONSHIP OF FORCE CONSTANT AND BOND LENGTH. Richard P. Smith (Univ. of Utah, Salt Lake City). J. Phys. Chem. 60, 1293-6(1956) Sept.

It is suggested that the force constant is inversely proportional to the square of the equilibrium internuclear distance for groups of molecules A–B where A and B are in the same column of the periodic table (e.g., O_2, SO, S_2, etc.). The relationship also seems to hold for hydrides of elements in the same column. A natural extension would be to suppose that $k_e R_e^2$ is constant for molecules A–B where A is in one particular column and B is in the same or another one, though data are not available to test the more general hypothesis. This relationship is compared to the bond length–bond energy correlation of a similar character recently proposed by Pauling. (auth)

RADIATION CHEMISTRY

11742 AERE-C/R-1575(4)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SELECTED ABSTRACTS OF ATOMIC ENERGY PROJECT UNCLASSIFIED REPORT LITERATURE IN THE FIELD OF RADIATION CHEMISTRY and BIBLIOGRAPHY OF THE PUBLISHED LITERATURE. (Papers Noted up to May 1956). PART 4. SOLID SYSTEMS (EXCLUDING ORGANIC COMPOUNDS). R. W. Clarke, comp. May 1956. 138p.

11743

CHEMICAL EFFECTS OF THE $C^{12}(\gamma,n)C^{11}$ REACTION IN CARBONATES. W. J. Edwards and K. J. McCallum (Univ. of Saskatchewan, Saskatoon, Canada). Can. J. Chem. 34, 189-92(1956) Mar.

The chemical effects following the carbon photoneutron reaction in $CaCO_3$ and $NaHCO_3$ have been studied. After solution of the irradiated crystals, C^{11} was found to be present in the forms of carbonate, carbon monoxide, formic acid, oxalic acid, glyoxylic acid, and glycollic acid. The relative amounts of C^{11} appearing in each form agreed closely with those found previously for irradiations of solid Na_2CO_3. (auth)

11744

RECOMBINATION OF RECOIL FRAGMENTS IN NEUTRON-IRRADIATED POTASSIUM CHROMATE. A. G. Maddock and M. M. de Maine (Univ. Chemical Labs., Cambridge, England). Can. J. Chem. 34, 275-83(1956) Mar.

The kinetics of the process whereby the retention increases on heating previously neutron-irradiated potassium chromate have been investigated. The results cannot be explained by any unimolecular or bimolecular mechanism, nor by a combination of a few such steps. The data are not compatible with the commoner diffusion-controlled mechanisms. Experiments on solid solutions of potassium chromate in potassium fluoberyllate suggest that the process involves the recombination of the fragments from individual rupture events. A tentative hypothesis, analogous to the theory of the formation of very thin oxide films on metals, is advanced and it accounts for all the existing data. (auth)

11745

THE OXYGEN EXCHANGE BETWEEN OXY-ANIONS AND WATER; BROMATE AND IODATE IONS. T. C. Hoering, R. C. Butler, and H. O. McDonald (Univ. of Arkansas, Fayetteville). J. Am. Chem. Soc. 78, 4829-31(1956) Oct. 5.

The kinetics of the isotopic exchange reaction between BrO_3^- and water has been studied. In the region of 0.02 to 0.80M BrO_3^-, the reaction follows the rate law $(R = k(H)^{+2}(BrO_3^-)$ where $k = 6.60 \times 10^{-3}$ liter^2/moles^2/second at 30.00° and ionic strength 0.900. The activation energy is 14,230 cal/mole. The course of the reaction is not affected by light, added Br_2 or increased surface area. The dependence on the H_2O concentration was not measured. The reaction proceeds faster in D_2O with k_D/k_H

equal to 1.72. The corresponding exchange between IO_3^- and water is complete in the time of separation of one minute. The exchange was studied under a number of different conditions. Different methods of separating the reactants were used. The rate of the bromate–water exchange is compared with that of the reduction of BrO_3^- by halide ions. (auth)

11746
KINETICS OF THE FERROUS IRON–OXYGEN REACTION IN SULFURIC ACID SOLUTION. Robert E. Huffman and Norman Davidson (California Inst. of Tech., Pasadena). J. Am. Chem. Soc. 78, 4836-42(1956) Oct. 5.

The kinetics of the reaction $4Fe^{2+} + O_2 \rightarrow 4Fe^{3+} + 2H_2O$ is studied and reaction paths, activation energies, rates, and factors influencing rates given and discussed. (T.R.H.)

11747
ENZYME ALTERATION BY IONIZING RADIATION. D. L. Aronson, M. J. Fraser, and C. L. Smith (Univ. of Cambridge, England). Radiation Research 5, 225-37(1956) Sept.

11748
INACTIVATION CROSS SECTIONS OF DRIED INVERTASE AND RIBONUCLEASE AS A FUNCTION OF LET. R. A. Deering (Yale Univ., New Haven, Conn.). Radiation Research 5, 238-46(1956) Sept.

11749
LIFETIME OF INTERMEDIATES IN WATER SUBJECTED TO ELECTRON IRRADIATION. J. A. Ghormley (Oak Ridge National Lab., Tenn.). Radiation Research 5, 247-51 (1956) Sept.

11750
STUDIES ON THE MECHANISM OF ACTION OF IONIZING RADIATIONS. XV. X-IRRADIATION OF OXYHEMOGLOBIN AND RELATED COMPOUNDS. E. S. Guzman Barron and Phyllis Johnson (Univ. of Chicago). Radiation Research 5, 290-302(1956) Sept.

11751
MECHANISM IN THE RADIOLYSIS OF AQUEOUS GLYCINE SOLUTIONS. II. Warren M. Garrison and Boyd M. Weeks (Univ. of California, Berkeley). J. Chem. Phys. 25, 585 (1956) Sept.

Chemical reactions are induced in aqueous glycine by radiolysis of H_2O, yielding H_2, NH_3, CH_3COOH, and glyoxylic acids in O_2-free systems. This has been explained by a reaction sequence. That a mechanism for the reaction can be formulated is shown. (T.R.H.)

11752
EFFECT OF RADIATION UPON THE EXCHANGE OF HYDROGEN AND ETHANOL. John G. Burr, Jr. (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 25, 587 (1956) Sept.

Organic substrates labeled with D or T produce by the action of high-energy radiation, H_2 gas containing some of the isotopic label. Subsequent radioinduced reactions redistribute the label in an unpredictable manner thus constituting a serious handicap in the use of this research tool. Experimental work is reported which shows that the exchange between molecular H_2 and combined H in organic molecules may be neglected in considering the radiolysis of a tracer-labeled organic molecule which reacts with H atoms. (T.R.H.)

11753
ISOTOPE FRACTIONATION STUDIES OF REACTIONS WITH CLEAVAGE OF A CARBON-14 TO HYDROGEN BOND IN THE RATE-DETERMINING STEP. Gus A. Ropp and Ernest M. Hodnett (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 25, 587-8(1956) Sept.

Fractionation of C isotopes in reactions for which the rate determining step involves C^{14}-H bond cleavage has been assumed to be immeasurable. The experimental work reported here seeks to test this assumption, by $C^{12}-C^{14}$ fractionating studies in the chromic acid oxidations at 37°C of 2-propanol and benzyl alcohol. (T.R.H.)

11754
KINETICS OF COMPETITIVE ISOTOPIC EXCHANGE REACTIONS. L. R. Darbee, F. E. Jenkins, and G. M. Harris (Univ. of Buffalo, N. Y.). J. Chem. Phys. 25, 605(1956) Sept.

A mathematical treatment of the kinetics of competitive isotopic exchange reactions such as the exchange of I^{131} with alkyl iodides is offered. (T.R.H.)

Refer also to abstract 12052.

RADIATION EFFECTS

11755 NP-6097
Stanford Research Inst., Menlo Park, Calif.
LITERATURE SURVEY OF RADIATION OF ADHESIVES AND RELATED MATERIALS. Literature Survey Report No. 1. Report No. 2. E. M. Kinderman and S. B. Radding, June 15, 1956. 75p. SRI Project No. SU-1726. Contract AF33(616)-3632.

Papers on polymerization by irradiation and irradiation of polymers with emphasis on formation, improvement, and degradation of polyethylene by radiation are abstracted for this bibliography. This work is directed at recording the latest advances in the rapidly changing field. (T.R.H.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

Refer to abstract 11707.

SEPARATION PROCEDURES

11756 AERE-C/R-1951
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PRODUCTION OF TRANSURANIUM ELEMENTS BY HEAVY ION BOMBARDMENT. PART I. RAPID CHEMICAL TECHNIQUES FOR ISOLATING ACTINIDE ELEMENTS FROM BOMBARDED URANIUM TARGETS. J. Milsted, A. B. Beadle, K. M. Glover, and J. H. Fremlin. May 1956. 18p.

In connection with the heavy ion bombardment program at Birmingham University, chemical methods have been developed by which higher transuranium elements can be isolated from a bombarded U foil in about 30 minutes. The foil is dissolved in a $HCl-H_2O_2$ mixture, and U is removed by anion exchange. A new type of macro evaporator is used to speed up the evaporation of the solution, and the actinides are finally separated by complexing elution from a cation exchange column. A comparison of three α-hydroxy acids, glycollic, lactic and α-hydroxy isobutyric, as eluting agents has shown that the latter acid gives much greater separation factors than the other two. (auth)

11757 JENER-Pub-11
Joint Establishment for Nuclear Energy Research, Kjeller, Norway.
TRACER EXPERIMENTS ON THE SOLVENT EXTRACTION OF NEPTUNIUM AND PLUTONIUM. J. Kooi. 1956. 61p.

The results of experimental studies on extraction of Np and Pu from HNO_3 solutions with $(C_2H_5)_2O$, dibutyl carbitol, and hexone are reported in the form of curves. For the Np and Pu measurements, Np^{239} and Pu^{239} were used. Uranium was determined by α measurements or weighing as U_3O_8 and Th by weighing as ThO_2. The results are

interpreted, and the reliability of tracer experiments in this type of work is discussed. (T.R.H.)

11758 ORNL-1927

Oak Ridge National Lab., Tenn.

SCOPE OF THE RAW MATERIALS COST EVALUATION STUDIES. E. F. Joseph, B. B. Klima, H. M. McLeod, Jr., A. D. Ryon, W. T. Ward, and R. R. Wiethaup—K. O. Johnsson, ed. Sept. 8, 1955. Decl. Jan. 10, 1956. 9p. Contract W-7405-eng-26. $0.15(OTS).

The scope of the cost estimating program for the immediate future is outlined, and the method to be employed in making the estimates is described, so that the costs of various processes may be compared on the same basis. The starting point for the cost estimates made is the slurry leaving the leach tanks. (W.L.H.)

11759 RMO-2010

International Minerals and Chemical Corp. Florida Experiment Station, Mulberry, Fla.

MIXED ACID PRECIPITATION OF URANIUM. W. J. McGinnis, R. F. McCullough, and J. G. Brown. Oct. 24, 1952. Decl. Oct. 26, 1955. 5p. Contract AT(49-1)-545. $1.80(ph OTS); $1.80(mf OTS).

Recovery of the U extracted from phosphatic solutions by kerosene solution of organic ortho or pyro phosphoric acids has been accomplished by precipitation with strong HF. Use of these concentrated HF solutions for precipitation of U normally reduce the U extractability of the organic phase to almost zero in three to seven cycles of the organic. The loss of solvent efficiency may be due to decomposition of the ester through a hydrolysis reaction which is accelerated by the strong HF. (auth)

11760

INTERPRETATION AND CORRELATION OF ION EXCHANGE COLUMN PERFORMANCE UNDER NONLINEAR EQUILIBRIA. Nevin K. Hiester and Shirley B. Radding (Stanford Research Inst., Menlo Park, Calif.) and Richard L. Nelson, Jr. and Theodore Vermeulen (Univ. of California, Berkeley). A.I.Ch.E. Journal 2, 404-11(1956) Sept.

Various methods are known for interpreting experimental data for linear-equilibrium cases or constant-pattern breakthrough curves where either external or internal diffusion alone controls the rate in the ion exchange column. The present paper provides interpretive techniques for nonlinear equilibrium cases where the rate is controlled by a combined diffusion mechanism. The techniques can be applied whether or not the value of the equilibrium constant is known. A completely general correlational method is derived for adding the mass transfer resistances under conditions of nonlinear equilibrium. Published breakthrough results from numerous sources and from new measurements, evaluated by the techniques described, are used to determine the numerical constants for the general correlation. (auth)

11761

REMOTE OPERATIONS IN U-235 PROCESSING. Charles A. Rohrmann (Hanford Atomic Products Operation, Richland, Wash.). Chem. Eng. 63, No. 10, 195-8(1956) Oct.

11762

CANADIAN FUEL REPROCESSING. W. M. Campbell (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nucleonics 14, No. 9, 92-7(1956) Sept.

The history of Canadian fuel reprocessing is outlined and flowsheets are given. The processes and their modifications are described up to the present ion-exchange process, and comments on future demands and economic considerations are included. (T.R.H.)

11763

STUDIES ON THE BENEFICIATION OF LOW GRADE BERYL ORES BY FLOTATION. N. R. Srinivasan and H. S. Aswath. J. Indian Inst. Sci. 38A, 135-42(1956) July.

This work was undertaken with a view to separating quartz and gangue from beryl in low grade beryl ores by froth flotation. The separation of quartz was attempted by flotation of quartz at a pH of above 11 using oleic acid and terpineol, barium chloride as activator for quartz and alizarin Red-S as depressant for beryl, and flotation of beryl at about pH 6 by using only oleic acid and terpineol. It was found that there was no selective separation in the case of flotation of quartz while good separations were obtained in the case of the flotation of beryl. A concentrate of 11.0% BeO was made at 84% recovery. (auth)

11764

LIQUID-LIQUID EXTRACTION—THEORY AND LABORATORY EXPERIMENTS. L. Alders. Amsterdam-Houston-London-New York, Elsevier Publishing Co., 1955. 206p.

11765

THE SOLVENT EXTRACTION OF PROTACTINIUM. A. Goble, J. Golden, and A. G. Maddock (Univ. Chemical Lab., Cambridge, England). Can J. Chem. 34, 284-92(1956) Mar.

The variation of the experimental extraction coefficient for protactinium upon dilution of the solvent ketone with benzene has been determined for aqueous solutions at constant concentration of hydrochloric acid. The bromo complex has been shown to be far less readily extracted. The effects on the extraction of the nitrate complex by amyl acetate, of the nitric acid, of the nitrate and hydrogen ion concentrations in the aqueous phase, as well as of the dilution of the solvent with benzene, have been explored. The existence of a slow reaction in the extraction has been demonstrated. It is concluded that chloride solutions are the more reliable for the isolation of protactinium from concentrates. (auth)

11766

THE SEPARATION OF ZIRCONIUM AND PROTOACTINIUM BY AN ANION-EXCHANGE COLUMN. S. Kahn and D. E. Hawkinson (Tracerlab, Inc., Richmond, Calif.). J. Inorg. and Nuclear Chem. 3, 155-6(1956) Sept.

Separation of Zr and Pa with Dowex-1 is investigated. Results are reported as a plot of log distribution coefficient (K_d) vs. molarity of HCl. (T.R.H.)

Refer also to abstracts 11716 and 11848.

SORPTION PHENOMENA

11767 AEC-tr-2648

RETENTION OF WATER VAPOR BY ALUMINA AND SILICA. Denis Papee. Translated by K. S. Bevis from Compt. rend. 234, 2536-8(1952). 3p.

The adsorption and desorption of water vapor on boehmite and bayerite and on silica gel and precipitated silica are studied. The phenomena are related to modifications in texture and structure. (T.R.H.)

11768 AEC-tr-2652

REHYDRATION OF ALUMINA AND ITS SIGNIFICANCE IN INTERPRETING THE ISOTHERMAL ADSORPTION OF WATER. Boris Imelik. Translated by K. S. Bevis from Compt. rend. 233, 1284-6(1951). 3p.

11769

ION-EXCHANGE STUDIES OF SOLUTIONS OF BORATES. D. A. Everest and W. J. Popiel (Battersea Polytechnic, London). J. Chem. Soc., 3183-9(1956) Aug.

The sorption of borate ions on an anion-exchange resin in the chloride form from 0.6, 0.4, 0.2, and 0.02M-boron solutions was studied, by means of equilibrium experiments at pH ~5.6 to 11.5. It reached a maximum at pH values which depended on the boron concentration. Polyborate ions were sorbed from ≤0.2M boron solutions at all but the

highest pH values, the degree of condensation increasing with decreasing pH and increasing boron concentration. From the quantity of boron and chloride sorbed by the resin, it is calculated that there is sorption of a mixture of $B_5O_8^-$, $B_4O_7^{2-}$ (or $HB_5O_9^{2-}$), and monoborate ions the relative amounts varying with the total boron concentration and the pH. The results appear to exclude the existence of a unique equilibrium in solution between $HB_5O_9^{2-}$ and $H_2BO_3^-$ existing over the whole pH range. (auth)

11770

THE INFERENCE OF ADSORPTION FROM DIFFERENTIAL DOUBLE LAYER CAPACITANCE MEASUREMENTS. Robert S. Hansen, Robert E. Minturn, and Donald A. Hickson (Iowa State Coll., Ames). J. Phys. Chem. 60, 1185-9(1956) Sept.

Frumkin's theory of the dependence of surface tension on polarization and solute activity is modified and extended to establish the dependence of differential capacitance on polarization and adsorption. The resulting equation is applied to experimental capacitances in the system mercury–0.1M perchloric acid–pentanoic acid. Variations of both actual and apparent adsorption with polarization are emphasized, and the relevance of these variations to the capacitance determination of adsorption is discussed. (auth)

11771

BIBLIOGRAPHY OF SOLID ADSORBENTS—1943 TO 1953. Victor R. Deitz, comp. Natl. Bur. Standards (U. S.) Circ. 566, 1956. 1528p. $8.75(GPO)

Adsorption of gases and vapors on solid adsorbents, adsorption from solutions on solid adsorbents, thermal effects in adsorption processes, theories of adsorption, refining of sugars and other applications of adsorbents, general information on adsorbents and special methods of investigation, and preparation of C adsorbents are the main headings included in the bibliography. (J.E.D.)

Refer also to abstract 11937.

TRACER APPLICATIONS

11772

PRODUCTION OF LABELED ORGANIC MATERIAL WITH ACCELERATED TRITIUM. Richard Wolfgang, Thomas Pratt, and F. S. Rowland (Florida State Univ., Tallahassee and Princeton Univ., N. J.). J. Am. Chem. Soc. 78, 5132 (1956) Oct. 5.

Organic compounds are T-labeled by placing a thin layer of them on a cathode in an atmosphere of 0.03 to 0.06 mm T_2 and applying a discharge of 100 μa at 500 v for 0.5 hr. Activities of the order of 0.1 mc/mg were obtained. (T.R.H.)

Refer also to abstract 11684.

TRANSURANIC ELEMENTS AND COMPOUNDS

Refer to abstract 11756.

TRITIUM AND TRITIUM COMPOUNDS

11773

THE DETERMINATION OF TRITIUM IN NATURAL WATERS. R. M. Brown and W. E. Grummitt (Atomic Energy of Canada Ltd., Chalk River, Ont. and Defence Research Chemical Labs., Ottawa). Can. J. Chem. 34, 220-6 (1956) Mar.

A study of the tritium content of rain- and sea-water samples collected during the past several years has been made. The tritium in 100 to 200 gm. samples was concentrated 2000 to 20000 fold by electrolysis and the final concentrate counted as hydrogen in a Geiger counter. Good counter characteristics were obtained at hydrogen pressures up to one atmosphere by the use of an electronic quench unit of suitable deadtime in addition to the internal quench gas, ethylene. Rain and snow samples collected at Ottawa over the period 1951 to 1953 were found to range from 17.1 to 42.0 tritium atoms per 10^{18} hydrogen atoms, averaging 26.6. Tritium values for Ottawa rain-water for 1954 showed marked effects of the thermonuclear tests in the Pacific in the spring of that year, rising 10 to 100 fold during the test period, then gradually returning to normal, demonstrating a half time for washout of 35 days. The average tritium concentration of the year's rain is estimated to be 260×10^{-18} T/H. Surface sea-water samples collected at widely separated sites in the latter half of 1954 and early 1955 showed tritium concentrations in the range 3.0 to 4.2×10^{-18} T/H, a value which corresponds with the amount of artificially produced tritium observed in Ottawa rain. Subsurface samples collected at one station off the coast of Nova Scotia in mid-1955 showed an unexpected concentration level and pattern, having a T/H value of 32.4×10^{-18} at the bottom depth of 600 ft., diminishing to a value of 5.4×10^{-18} at the surface. This is not thought to be a result of thermonuclear testing and warrants further investigation. (auth)

11774

INFRARED SPECTRUM OF TCN. P. A. Staats, H. W. Morgan, and J. H. Goldstein (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 25, 582(1956) Sept.

The infrared spectrum of TCN was studied in the region 4,000 to 400 cm^{-1} and the frequency data are summarized and discussed along with data on HCN and DCN for comparison. The method of preparation and purification of TCN is briefly described. (T.R.H.)

Refer also to abstract 11772.

URANIUM AND URANIUM COMPOUNDS

11775 CC-1974

[Chicago. Univ. Metallurgical Lab.]

A SUMMARY OF THE PROPERTIES, PREPARATION, AND PURIFICATION OF THE ANHYDROUS CHLORIDES AND BROMIDES OF URANIUM. PART A. URANIUM CHLORIDES. O. Johnson and T. Butler. PART B. URANIUM BROMIDES. J. Powell and R. Nottorf. Sept. 15, 1944. Decl. Nov. 14, 1955. 25p. $0.25(OTS).

A summary is presented giving all available data on the properties, preparation, and purification of anhydrous uranium chlorides and uranium bromides. Data are given for UCl_3, UCl_4, UCl_5, UCl_6, $UOCl_2$, UO_2Cl_2, UBr_3, UBr_4, $UOBr_5$, UO_2Br_2, and the UBr_3–UBr_4 system. (auth)

11776

HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF URANYL CHLORIDE FROM 6 TO 350°K. Elliott Greenberg and Edgar F. Westrum, Jr. (Univ. of Michigan, Ann Arbor). J. Am. Chem. Soc. 78, 4526-8(1956) Sept. 20.

Measurements of C_p of pure, anhydrous UO_2Cl_2 from 6 to 350°K were made and the entropy, enthalpy, and free energy function calculated. At 298.16°K the molal values of C_p, S^0, and $H^0-H_0^0$ are 25.78 ± 0.04 cal/deg., 35.98 ± 0.05 cal/deg., and 5157 ± 8 cal, respectively. There was no detectable evidence of anomalous heat capacity behavior or significant magnetic contributions to the thermal properties. (auth)

Refer also to abstract 11759.

WASTE DISPOSAL

11777 AECU-3359

[Los Alamos Scientific Lab., N. Mex.]

TREATMENT OF WASTES CONTAINING RADIOACTIVE BARIUM, LANTHANUM, STRONTIUM, AND YTTRIUM. [J. P. Hutchinson, E. H. Rex, E. R. Mathews, and C. W. Christenson]. [1956]. 15p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40(mf OTS).

The design and operation are described of a plant for the treatment of wastes containing radioactive Ba, La, Sr, and Y. The method combines tank storage and cation exchange for separation of the radioisotopes. A flow diagram of the plant is included. Essentially it consists of a rate of flow regulator to control flow of waste pumped from a storage tank, a resin column, and equipment for regeneration and treatment of spent regenerant. Plant operating data are summarized. (C.H.)

11778 CF-55-6-152

Oak Ridge National Lab., Tenn.

ECONOMIC REQUIREMENTS FOR RADIOACTIVE WASTE DISPOSAL IN A NUCLEAR POWER ECONOMY. H. R. Zeitlin. June 9, 1955. 12p. Contract [W-7405-eng-26]. $0.15(OTS).

An attempt has been made to define the limits on the tolerable cost per initial gallon of liquid radiochemical process waste as a function of reactor operating and design characteristics, the radiochemical separations process employed and the fraction of 8 mill/kwhr power which is allocated to the disposal of wastes. The allowable cost of waste disposal for the case in which the reactor burnup is 5,000 MWD (heat)/ton, the processing waste volume 1200 gals/ton, and the allocated cost for waste disposal 2% (or 0.16 mills/kwhr$_e$) is $4/gallon. (auth)

Refer also to abstract 11949.

ENGINEERING

11779 NYO-4608

Harvard Univ., Boston. Air Cleaning Lab.

AIR CLEANING STUDIES. Progress Report for July 1, 1953 to June 30, 1954. Richard Dennis, Leslie Silverman, Charles E. Billings, August T. Rossano, Jr., Edward Connors, Jr., Richard D. Coleman, David M. Anderson, William R. Samples, and Philip Drinker. Jan. 15, 1956. 58p. Contract AT-(30-1)-841. $0.40(OTS).

Investigations on the principles of cloth filtration, the role of electrostatic forces in gas cleaning, and studies on resistance and filtration characteristics of fiber beds were continued during the period. New projects included rating of several types of roughing filters, evaluation and testing of stain efficiency techniques, and a study of blast damages to and re-entrainment from high efficiency filters. (For preceding period see NYO-1591.) (C.H.)

11780 ORNL-2132

Oak Ridge National Lab., Tenn.

THE ORGANIZATION, ADMINISTRATION, AND OPERATION OF A RADIOCHEMICAL PILOT PLANT. G. S. Sadowski. Oct. 3, 1956. 95p. Contract W-7405-eng-26. $0.50(OTS).

A guide for the technical personnel in a pilot plant is presented which will serve to implement their training as pilot plant engineers or chemists. The contents are derived from experiences in a number of pilot plant programs and a typical one, the organization and operation of the Thorex Pilot Plant, is used as a model. (T.R.H.)

HEAT TRANSFER AND FLUID FLOW

11781 AD-92461

Princeton Univ., N. J. Forrestal Research Center.

A SELECTIVE BIBLIOGRAPHY APPLYING TO HEAT TRANSFER IN OSCILLATING FLOW. Literature Search No. 7. Maurice H. Smith and J. P. Layton, comps. Mar. 9, 1955. 43p.

The items included were selected for their usefulness in the problems of heat transfer in oscillating flow in closed passages. Material on instrumentation and experimental techniques is included. (T.R.H.)

11782 AEDC-TR-55-11

Arnold Engineering Development Center, Tullahoma, Tenn.

ANALYSIS OF GAS FLOW SYSTEMS FOR DYNAMIC CONTROL PURPOSES. W. K. McGregor, Jr., D. W. Russell, R. W. Messick, and L. F. Burns. Apr. 1956. 60p. Contract AF40(600)-620. (AD-88130).

Results of an investigation of the problems involved in the design of an automatic pressure control system for the Engine Test Facility and Ram-Jet Addition, Arnold Engineering Development Center are presented. Methods are developed for the prediction of frequency and indicial response of gas flow systems on both a lumped parameter and a distributed parameter basis. Examples are presented in the appendices to add clarification to the method and its implications. The report correlates existing knowledge of gas flow systems as a basis for formulating an inclusive reference to be used in the design of a gas flow system having desirable dynamics and in the design of control systems. (auth)

11783 PWAC-154

Trane Co., La Crosse, Wisc.

HEAT TRANSFER AND FLOW FRICTION CHARACTERISTICS OF BRAZED SANDWICH TYPE EXTENDED SURFACES. Technical Phase Report No. 1. Henryk Hurwicz. Oct. 1955. Fox Project. 69p. For Pratt and Whitney Aircraft Div. Contract AF33(038)-27341.

Bound under a Pratt and Whitney cover with the title "THE TRANE COMPANY TECHNICAL PHASE REPORT ON THE ANALYSIS AND TESTING OF FIVE EXTENDED HEAT-TRANSFER SURFACES," with preface by A. J. Herman. Sept. 10, 1956. 2p.

Five extended brazed sandwich type surfaces were tested in air-to-air crossflow tests to ascertain their heat transfer and flow friction characteristics. Two standard Trane herring-bone surfaces and three wavy experimental fin modifications were investigated and their performance compared with straight fins. A comparison of the results was made with data available in Stanford Reports on herringbone fins. The effects of heating and cooling of air on the isothermal friction factors were investigated. (auth)

11784 WAPD-SFR-AS(M)-539

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

HEAT TRANSFER SUBSTANCES and COMPRESSION FITTING TEST NUMBER 2. J. L. Dempster. [1956?]. 16p. Project No. 34b34. $3.30(ph OTS); $2.40(mf OTS).

The fittings were tested to determine their effectiveness as seals when subjected to thermal cycling between approximately 350 and 625°F. The mechanical compression seal insures the integrity of the pressurized system against burnout of the heater well and possible loss of fluid to atmosphere. The method of installation is shown. (auth)

11785 AEC-tr-2567

A SIMILARITY INTEGRAL FOR VORTEX AND TEMPERATURE FIELDS. A. M. Fainzilber. Translated from Doklady Akad. Nauk S.S.S.R. 100, 225-8(1955). 6p.

Integrals of hydrodynamic equations for flow of viscous gases past profiles of arbitrary shape and for variable surface temperature are derived. (T.R.H.)

11786 DTMB-Trans-110

THE SIZE OF GAS BUBBLES IN LIQUIDS. (Dis Grösse von Gasblasen in Flüssigkeiten). Robert Schnurmann. Translated by F. A. Raven from Z. physik. Chem. 143, 456-74 (1929). 19p.

The size of gas bubbles forced through a filter into a liquid depends on the nature of the liquid and is independent of the character of the filter. The size of the bubble as a function of the viscosity of the liquid is shown for dielectric fluids, acids, bases, and salt solutions. The mechanism of macroscopic bubble formation is observed and considered. In electrolytic solutions the additional factor of the electrostatic interaction of the charged gas bubbles is added to the effect of viscosity. This interaction permits determination of the order of magnitude of the concentrations of reversal of solutions whose viscosity does not perceptibly exceed that of water. The experimental result permits interpretation of the scatterings obtained upon determination of the pore diameters of ceramic filters for various liquids by the air pressure method. Applications for gas absorption by liquids, and flotation are discussed. (auth)

11787

RATE OF FLOW AND MECHANICS OF BUBBLE FORMATION FROM SINGLE SUBMERGED ORIFICES. Irving Leibson, Eugene G. Holcomb, Anthony G. Cacoso, and John J. Jacmic (U. S. Army Chemical Corps, Camp Detrick, Md.). A.I.Ch.E. Journal 2, 296-306(1956) Sept.

A study has been made of the rate of flow and mechanics of bubble formation from single submerged orifices 1/64, 1/32, 1/16, and 1/8 in. in diameter installed in an 8-in. I.D. column operating in the air-water system. The coefficients of discharge obtained for sharp-edged orifices operating with this system indicate that the effective orifice discharge area for this type of operation is greater than that for an orifice of the same size and type operating at the same pressure ratio in the air-air system. The effective orifice discharge areas for a round-edged orifice operating in either the air-water or air-air systems appear to be identical at the same pressure ratio. The thick-plate orifice operating in the air-water system exhibits a constancy of discharge coefficient at ratios of the downstream to upstream pressures less than 0.33. Inasmuch as bubble formation occurring close to the downstream face of a sharp-edged orifice operating in the air-water system influences the effective orifice discharge area, liquid physical properties may be expected to be important in determining the rate of flow from this type of orifice for other gas-liquid systems. Photographic studies of bubble formation reveal that nonuniformity of bubble size is initiated by the onset of turbulence in the air stream flowing through the orifice. In the section of the laminar-flow range studied in this investigation ($200 < N_{Re} < 2{,}100$) the frequency of bubble formation is nearly constant with respect to Reynolds number. The bubble size is relatively uniform at a given Reynolds number and depends markedly upon orifice diameter. Stroboscopic examination reveals that as turbulence is fully developed for the air flow through the orifice, a counterclockwise spiraling, swirling motion of the air jet is initiated. In the turbulent-flow range the bubblesize-distribution data are fitted reasonably well by a logarithmic-normal-probability distribution. (auth)

11788

FORMATION OF GAS BUBBLES AT HORIZONTAL ORIFICES. Leon Davidson and Erwin H. Amick, Jr. (Columbia Univ., New York). A.I.Ch.E. Journal 2, 337-42(1956) Sept.

Air bubbles were formed in water and in mineral oil by use of single, circular, horizontal, square-edged orifices facing upward. Twenty orifices were tested, ranging from 0.017 to 0.79 cm (0.0067 to 0.31 in.) in radius. Increasing the volume of the gas chamber below the orifice (over the range of 4 to 4,000 cc.) was found to increase the bubble size. The gas-chamber volume was minimized in most of the work in order to confine attention to the effects of orifice size and gas-flow rate. The liquid containers were large enough to eliminate significant wall effects, and operations were conducted at atmospheric pressure. The gas-flow rate was varied from about 0.01 to about 250 cc/sec. over the course of the work. At relatively low flow rates, the orifices generally formed single "static" bubbles, the volumes of which were proportional to the surface tension and orifice radius and independent of the gas-flow rate. At high flow rates the bubble frequency became high and the bubble volume became proportional to the gas-flow rate and independent of the surface tension. The bubble frequency reached a maximum value for each orifice, this value being a function of the orifice radius. For air bubbles in water, the correlation of the maximum bubble frequency, n_m bubbles/sec., with the orifice radius, r cm., and the air-flow rate, q cc./sec., was found to be $n_m = 9.1q^{0.13}/r^{0.43}$. The maximum frequencies ranged from about 25 bubbles/sec. for the largest orifices to about 75 bubbles/sec. for the smallest orifices used. It was found that consecutive bubbles paired or coalesced in definite ways in certain ranges of the gas-flow rate. A description is given of this bubble behavior, based on stroboscopic and photographic observation. (auth)

11789

LIQUID METALS AS HEAT TRANSFER MEDIA. Nuclear Eng. 1, 238-40(1956) Sept.

Many processes which have been developed specifically for atomic energy applications will be taken over and further developed by other industries. The extension of the use of NaK as a heat transfer medium to conventional chemical engineering fields can lead to considerable advances in the over-all technology. (auth)

11790

THE STRUCTURE OF TURBULENT SHEAR FLOW. A. A. Townsend. Cambridge, University Press, 1956. 315p.

A description of turbulence is presented, and general principles and hypotheses about the nature of turbulent motion are discussed. Topics such as the equations of motion in shear flow, flows without appreciable variation of mean velocity, the uniform distortion of homogeneous turbulence, free turbulence, the turbulent wake, turbulent jets, turbulent flow in pipes and channels, boundary-layer flow without pressure gradient, boundary-layer flow in a pressure gradient, and shear flow between rotating cylinders are discussed. (J.H.M.)

Refer also to abstract 12015.

MATERIALS TESTING

11791 AD-76224

Wayne Univ., Detroit and Stanford Univ., Calif.

DESIGN OF OPTIMUM LIFE TEST PROCEDURES. Technical Report No. 6. Benjamin Epstein. Sept. 30, 1955. 20p. Contract DA-20-018-ORD-13272.

Life test procedures where one simple hypothesis is tested against another simple hypothesis are discussed. To illustrate the methods proposed numerical examples are worked out in detail. (J.H.M.)

11792 AECU-3256

Oak Ridge Gaseous Diffusion Plant, Tenn.

HAYNES ALLOY 25 SPRING MATERIAL. K. T. Ziehlke.

Jan. 26, 1956. 2p. Contract [W-7405-eng-26]. (KLI-3695). $1.80(ph OTS); $1.80(mf OTS).

Springs have been tested and compared to new springs to determine whether significant changes have taken place in their properties during the 5 months they were in operation. Springs held at 1200°F for 16 hours showed a permanent set which reduced the initial 400 pound load to about 250 pounds. The final length of these springs was about the same as that measured on springs removed for inspection after five months at 1050°F. There was no change in spring constant after the 1200°F test exposure nor after the service exposure at 1050°F. Further testing after an additional 4 to 6 months service would permit an estimate to be made of the creep rate in order that a suitable maintenance interval might be established. (auth)

11793 NP-6099

Shell Development Co., Emeryville, Calif.

RESEARCH IN HIGH TEMPERATURE BEARING LUBRICATION IN THE ABSENCE OF LIQUID LUBRICANTS. Progress Report No. 4 for May through July 1956. C. H. Bailey and S. S. Sorem. 12p. Contract AF33(616)-2999. (S-13697).

A beneficial reaction takes place between air and liquid JP-4 when they are mixed in a common, relatively cool, delivery tube before entering the test bearing housing. When the delivery tube is hot enough to completely vaporize all JP-4 there is a reduction in the effectiveness of the "protective atmosphere". The upper temperature limit for satisfactory "protective atmosphere" operation of a tool steel roller bearing in an air-JP-4 (weight ratio 8) atmosphere is approximately 800°F. 1%w toluidine is an effective additive to benzene for greatly improving "protective atmosphere" operation of an air-benzene (weight ratio 8) atmosphere. (auth)

11794 NYO-1595

Harvard Univ., Boston. Air Cleaning Lab.

BLAST DAMAGE TO AIR CLEANING DEVICES. (Filter Tests). Progress Report for July 1, 1953 to June 30, 1955. Charles E. Billings, Richard Dennis, and Leslie Silverman. Nov. 28, 1955. 56p. Contract AT-(30-1)-841. $0.30(OTS).

Results of studies of the effect of shock waves impressed on air filters in a direction opposite to normal air flow are summarized. Moderate damage to Dust-Stop prefilters occurs at shock over-pressures greater than one inch of mercury, severe damage occurring at pressures greater than three inches of mercury. At one inch over-pressure large amounts of dust are removed from the filter but physical damage is slight. Pleated A.E.C. No. 1 filters (24 × 24 × 6 inch) were found to sustain moderate damage at a pressure of six inches of mercury and a pressure of ten inches caused complete destruction. Pressures of five inches of mercury or less caused no apparent physical damage. A filter with perforated aluminum plates nailed to both faces had no additional strength to resist blast pressure. Reentrainment studies have indicated large amounts of dust will be dislodged from a filter by the action of a shock wave. (auth)

RADIOGRAPHY

11795

ADAPTING THE UNIVERSAL EXPOSURE CALCULATOR FOR RADIUM RADIOGRAPHY TO RADIOGRAPHY WITH IRIDIUM-192. J. C. Austin and P. Richards (Brookhaven National Lab., Upton, N. Y.). Non-Destructive Testing 14, No. 4, 16-17 & 25(1956) July-Aug.

The Universal exposure calculator for radium radiography is a useful tool, aiding the consistent production of gammagraphs of good quality. It has been successfully adapted to produce similar results in iridium-192 radiography. It is suggested that techniques presented here can be used to adapt the calculator to other isotopes and to make it a useful tool to the x-ray technician. (auth)

11796

IRIDIUM-192 PROVES USEFUL INSPECTION TOOL IN THE AIRCRAFT INDUSTRY. Clive Yeomans and Stephen Bellanca (Glenn L. Martin Co., Baltimore). Non-Destructive Testing 14, No. 4, 32-4(1956) July-Aug.

The experience in the application of Ir^{192} for inspection of aircraft components and welded assemblies that do not lend themselves conveniently to x-ray inspection is described. (auth)

11797

APPLICATIONS AND PROBLEMS IN STROBORADIOGRAPHY. Cass Mitchell (General Electric Co., Detroit) and Raymond A. Pulk (Detroit Arsenal, Center Line, Mich.). Non-Destructive Testing 14, No. 5, 24-7 & 31(1956) Sept.-Oct.

Application of the stroboscopic principle to the radiographic study of mechanisms undergoing high-speed repetitive motion, by using synchronized bursts of x radiation from the 5 to 15-Mev betatron, is discussed. The construction of the synchronizing device is described, and some initial results from the Detroit Arsenal are presented. (auth)

11798

DISCUSSION OF "NOMOGRAMS FOR IRIDIUM-192 RADIOGRAPHY." T. A. Cosh (British Steel Castings Research Assoc., Sheffield, England). Non-Destructive Testing 14, No. 5, 42-4(1956) Sept.-Oct.

MINERALOGY, METALLURGY, AND CERAMICS

11799 AEC-tr-2485

DEPOSITION OF FINELY-DIVIDED MATERIALS ON THE WALLS OF CONDUITS. (Über das Ansetzen Fein Verteilter Stoffe and den Wänden von Strömungskanälen). H. Rumpf. Translated from Chem. Ing. Tech. 25, 317-27(1953). 44p.

Basic conditions for wall deposit formation and prevention of this formation in the flow of powder dispersions in air and gases were investigated. Information was based on systematic observations and experiments in the flow of powder-gas suspensions with deposit occurring on conduit walls. (F.S.)

CERAMICS AND REFRACTORIES

11800 WADC-TR-53-265

National Bureau of Standards, Washington, D. C.

THE PLASTIC DEFORMATION OF CERAMIC-OXIDE SINGLE CRYSTALS. Period [covered] October 1, 1950 through June 30, 1953. John B. Wachtman, Jr., and Laurel H. Maxwell. July 1953. 42p. Contract AF33(038)-51-4056. (AD-27292).

A study was made of the temperatures at which periclase, rutile, and sapphire deform plastically. Periclase can be plastically deformed above 1100°C, rutile above 600°C, and sapphire above 900°C. These temperatures are approximately one-half the melting temperatures on the absolute-scale and this agreement suggests that other ceramic oxide single crystals also may deform plastically at one-half their melting temperatures. Studies of slip lines and

orientation changes during deformation have indicated that the geometry of plastic deformation in ceramic oxide single crystals is the same as that in metals. It has been shown that deformation in sapphire takes place by slip on the (0001) plane in the [11$\bar{2}$0] direction. Creep curves for sapphire in tension all show the same qualitative features. Each consists of three stages: a stage of increasing creep rate, a stage of large but decreasing creep rate and a stage of small and nearly constant creep rate. Measurements of the electrical resistivity of sapphire as a function of temperature have been made. (auth)

11801 AEC-tr-2612

DIELECTRIC STRENGTH OF TITANATES OF METALS IN GROUP II OF THE PERIODIC TABLE FOR A HIGH FREQUENCY VOLTAGE. G. I. Skanavi and V. I. Sarafanov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 595-604(1954). 11p.

A study of the dielectric strength of titanates of Zn, Mg, Ca, Sr, and Ba is conducted at high voltages and at frequencies ranging from 140 kc to 4 mc. An attempt is made to establish the nature of the thermionic breakdown which occurs. (T.R.H.)

11802 AEC-tr-2625

FERROELECTRIC PROPERTIES OF SOLID SOLUTIONS OF BARIUM ZIRCONATE IN BARIUM TITANATE. G. A. Smolenskii (Smolensky), N. P. Tarutin, and N. P. Grudtsin. Translated from Zhur. Tekh. Fiz. 24, 1584-93(1954). 10p.

The piezoelectric modulus and dielectric permeability of various solutions of $BaZrO_3$ in $BaTiO_3$ are measured. The special apparatus is described. (T.R.H.)

11803

THERMAL PROPERTIES OF ALUMINUM OXIDE FROM 0° TO 1,200°K. George T. Furukawa, Thomas B. Douglas, Robert E. McCoskey, and Defoe C. Ginnings. J. Research Natl. Bur. Standards 57, 67-82(1956) Aug.

Accurate measurements of the heat capacity of α-aluminum oxide (corundum) from 13 to 1,170°K are described. An adiabatic calorimeter was used from 13 to 380°K and a drop method was used with a Bunsen ice calorimeter from 273 to 1,170°K. The results are compared in the range 273 to 380°K, where the two methods overlap. From the data, smoothed values of the heat capacity, enthalpy, entropy, and Gibbs free energy from 0 to 1,200°K are derived and tabulated. (auth)

CORROSION

11804 AERE-C/M-115

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ELECTRON DIFFRACTION IN THE STUDY OF SURFACE CORROSION REACTIONS. B. A. J. Lister. July 2, 1951. 8p.

A survey was made of published work dealing with the use of the electron-diffraction technique in the study of surface corrosion reactions. (auth)

11805 CF-55-4-36

Oak Ridge National Lab., Tenn.

COMMENTS ON THE EROSIVENESS OF ThO_2 SLURRIES. D. G. Thomas. Apr. 5, 1955. Decl. July 31, 1956. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A mechanism of erosive attack is proposed and applied to typical toroid and loop tests. The results of the analysis indicate that for specific components, i.e., toroid pins and loop orifice plates, only particles greater than 3 to 10 microns diameter (less than 15% by weight or the solids) are effective in causing attack. Tests are suggested to determine the validity of the proposed mechanism. (auth)

11806 CF-55-12-32

Oak Ridge National Lab., Tenn.

PRELIMINARY INVESTIGATION INTO CAKE FORMATION DURING SLURRY TEST 200A-3. R. N. Lyon and D. G. Thomas. Dec. 6, 1955. Decl. July 31, 1956. 23p. Contract [W-7405-ENG-26]. $4.80(ph OTS); $2.70(mf OTS).

During the third 200 gpm slurry loop run to test the 200 A impeller pump, about 50% of the circulated solids deposited on the pipe walls as a hard intractable cake. A description of the complete 200A-3 run, from initial loading to final inspection and cleaning, is given. (F.S.)

11807 OSR-TN-56-435

Princeton Univ., N. J. Forrestal Research Center.

PLASTIC FLOW OF IRON OXIDES AND THE OXIDATION OF IRON. Metallurgy Report No. 10. J. D. Mackenzie and C. E. Birchenall. Aug. 31, 1956. 10p. Contract AF18(600)-967. (AD-96518).

The oxidation of Fe in O_2 at high temperatures is accompanied by the formation of a central box-like cavity the dimensions of which are identical to those of the original iron specimen. The decrease in size of this cavity with increasing temperature and its disappearance when the formation of magnetite and hematite is excluded by a controlled oxidizing potential indicates that the plastic properties of the oxides may be an important factor. This is qualitatively confirmed by the measurement of the relative plasticity of the three oxides at 800 to 1000°C in a specially designed apparatus. (auth)

11808 RIA-55-4161

Rock Island Arsenal Lab., Ill.

THE USE OF VOLATILE CORROSION INHIBITORS AS A PRESERVATIVE MEDIUM FOR LONG TERM STORAGE OF ORDNANCE MATERIEL. ADDENDUM V. RESULTS AFTER SIX YEARS OF EXPOSURE. Report No. 10. R. E. Johnson. Nov. 3, 1955. 24p. DA Project No. 591-07-001. (AD-78467).

After six years in storage, two volatile corrosion inhibitors and three petrolatum type corrosion preventives employed in packaging stored ordnance materiel were evaluated comparatively for the long term protection of gun and howitzer tubes, hydropneumatic recoil rods and cylinders, sintered iron specimens, and non-ferrous specimens. The sixth yearly inspection was performed according to the schedule proposed at the initiation of the test to observe the performance of the protective materials in indoor and outdoor storage. The inhibited papers were analyzed for inhibitor content to determine the total amount of inhibitor remaining on the wrapper after six years in storage. (auth)

11809 WADC-TR-54-527(Suppl. 1)

United States Stoneware Co., Tallmadge, Ohio.

THE DEVELOPMENT OF A PROTECTIVE COATING RESISTANT TO NITRIC ACID AND HYDROCARBONS. [Period covered] May 15, 1954 through July 15, 1955. D. F. Siddall, E. Hillier, R. Garling, and M. Gunther. June 1956. 115p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ORGANIC PROTECTIVE COATINGS. Contract AF33(616)-150.

Resin X-200 (Kel-F 800), a new fluorinated fuming HNO_3 resistant material was formulated as a lacquer and a filleting putty. Application procedures were developed, and resistance of the lacquer coating, the filleting putty, and the complete system in FNA and JP-4 fuel were determined. Results indicate that the X-200 system is suitable for application on aircraft metals. When force dried at 300°F, FNA resistance approaches that of fused Kel-F. Resistance of the system when air dried is considerably lower but improves slowly over a long period of time as residual solvent evaporates. The coating system softens in JP-4 fuel after 3 days at 125°F. (auth)

11810

AQUEOUS CORROSION OF ALUMINUM. PART 2. METHODS OF PROTECTION ABOVE 200°C. J. E. Draley and W. E. Ruther (Argonne National Lab., Lemont, Ill.). Corrosion 12, 480t-90t(1956) Oct.

At elevated temperatures most Al alloys in water suffer severe penetrating attack, resulting in their relatively rapid destruction. This penetrating attack is explained in terms of mechanical damage as a result of diffusion of corrosion-product H into the metal. It is prevented by adding to the water cations which are reduced on the Al to form deposits of low H overvoltage metals. It is also prevented in untreated water by using Al alloyed with the same metals. Alloying metals observed to be beneficial are Ni, Cu, Co, Fe and Pt, with Ni probably the most effective. There has been developed an alloy, containing approximately 1% Ni in 1100 Al, which appears to be completely safe against the penetrating attack up to 350°C. It is easy to make and is workable. It probably can be used, from a corrosion-resistant point of view, wherever its normal reaction rate with water or a solution is tolerable. Penetration rates in static distilled water range from approximately 0.5 mg/dm^2-day at 150°C to 18 mdd at 350°C (0.3 to 9 mils per year). They are higher where there is significant flow velocity of water past metal. (auth)

11811

APPLICATION OF THE STATISTICAL THEORY OF EXTREME VALUES TO THE ANALYSIS OF MAXIMUM PIT DEPTH DATA FOR ALUMINUM. P. M. Aziz (Aluminum Labs. Ltd., Kingston, Ont., Canada). Corrosion 12, 495t-506t(1956) Oct.

Pit depth distribution curves were constructed for 2S Al immersed in tap water for time period of two weeks, one, two, four and six months, and one year, respectively. The distribution curves were found to consist of two superimposed curves. A "J" shaped curve resulted from pits which initiated and stifled within two weeks of immersion, whereas the other, a "bell" shaped curve, resulted from pits that initiate and continued to propagate. The "bell" shaped curve retained its shape and moved in the direction of increasing pit depth. After about two months the majority of these latter pits ceased propagating, the mode of the bell shaped curve became stationary, and only a small number of the deeper pits continued to propagate, the tail of the distribution curve lengthening with time. The maximum pit depths obtained on each of replicate samples were analyzed by the statistical theory of extreme values using the appropriate probability paper and were found to fit the extreme value distribution:

$$\Phi y = e^{-e^{-y}}$$

From this it was shown that the maximum pit depth is linear in the logarithm of the exposed area thus providing a rational method of extrapolating pitting data obtained in the laboratory on small samples to large scale field installations. This fit of maximum pit depth data to the extreme value distribution also makes possible the extraction of more information from a limited number of pit depths than has been possible heretofore. (auth)

11812

INITIAL OXIDATION RATE OF METALS AND THE LOGARITHMIC EQUATION. Herbert H. Uhlig (Massachusetts Inst. of Tech., Cambridge). Acta Met. 4, 541-54(1956) Sept.

The logarithmic oxidation equation $y = k_0 \ln (t/\tau + 1)$ is derived assuming control of the rate by electron flow from metal to oxide. Electron flow during oxidation, in turn, is a function of a changing less-positive or a more-negative space charge in the oxide extending up to several thousand angström units from the metal surface, where increasing numbers of trapped electrons at lattice defect sites account for the changing space charge. The space charge is composed of two parts: a uniform-charge density layer next to the metal and a diffuse-charge density layer beyond the uniform layer. Oxidation follows the logarithmic equation during formation of both space-charge layers, but not afterward, with a higher oxidation rate accompanying formation of the diffuse layer. It is shown that under some circumstances the particular distribution of negative charge in the diffuse layer may lead to the cubic oxidation equation. Experimental conditions, especially impurities present in the oxide and its heat treatment, probably determine which electric-charge distribution is favored. For oxidation beyond the space-charge layer, either the linear equation is obeyed, with control of the rate still focused at the metal-oxide interface, or, more frequently, the parabolic equation is obeyed with control centered in diffusion and migration processes in the oxide, in accord with Wagner's theory. From oxidation data for copper, the density of trapped electrons in the uniform charge density Cu_2O layer at 150° is calculated to be 1.3×10^{15}, which decreases to 6×10^{13} at 250°C. The number of available sites for trapped electrons in the diffuse layer is calculated correspondingly to be 1.0×10^{14} and 2.6×10^{12} respectively. The thickness of the uniform charge density layer varies from 360 A at 150° to 1630 A at 250°C. The Rideal-Jones empirical relation $\Delta E = \phi - 3.6$, where ΔE is the activation energy for oxidation and ϕ the metal-work function, both in electron volts, and which has been shown to hold for carbon, tungsten, and platinum, is shown herewith to apply to nickel, tantalum, and titanium, and more approximately to copper and iron. This relation is derived theoretically from the same fundamental assumptions used in deriving the logarithmic oxidation equation. (auth)

11813

EFFECT OF PRIOR CORROSION HISTORY ON THE CORROSION OF ZIRCALOY-2 IN HIGH TEMPERATURE WATER. D. E. Thomas and S. Kass (Westinghouse Electric Corp., Pittsburgh). J. Electrochem. Soc. 103, 478-82(1956) Sept.

A method is presented which permits in a relatively short time the prediction of the corrosion behavior of Zircaloy-2 after very long exposure times in high temperature water. The technique, which is of practical value, involves changing the corrosion test temperature, and yields transient effects which are of interest from a theoretical point of view. (auth)

11814

MATHEMATICAL STUDIES OF GALVANIC CORROSION. VI. LIMITING CASE OF VERY THIN FILMS. J. T. Waber (Los Alamos Scientific Lab., N. Mex.). J. Electrochem. Soc. 103, 567-70(1956) Oct.

The limiting case of a very thin electrolyte layer which covers a coplanar electrode arrangement has been analyzed by making the electrode dimensions infinitely larger than the corrodent depth. A Fourier integral expression for the potential throughout the corrosion medium has been derived from the Fourier series treatment of the potential pertinent to finite electrode widths. The electrolyte depth becomes the critical cell dimension. The variation of the potential along the inner and outer boundaries of the liquid are presented in two graphs with a separate curve for each value of the ratio of the liquid depth to the Wagner polarization parameter. The distribution of the corrosion current over the anode is also presented graphically as a function of this ratio. (auth)

GEOLOGY AND MINERALOGY

11815
URANIUM AND VANADIUM DEPOSITS OF THE COLORADO PLATEAU THAT PRODUCED MORE THAN 1,000 TONS OF ORE THROUGH JUNE 30, 1955. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-54. Randall T. Chew, III. Washington, U. S. Geological Survey, 1956. $0.50.

11816
PRELIMINARY GEOLOGIC MAP OF THE NORTHEAST PART OF THE EDGEMONT NE QUADRANGLE, CUSTER AND FALL RIVER COUNTIES, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-56. G. B. Gott and R. W. Schnabel. Washington, U. S. Geological Survey, 1956. $0.50.

11817
PHOTOGEOLOGIC MAP OF THE LEES FERRY SE QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-169. Kathleen McQueen. Washington, U. S. Geological Survey, 1956. $0.50.

11818
PHOTOGEOLOGIC MAP OF THE PARIA PLATEAU SW QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-171. J. P. Minard. Washington, U. S. Geological Survey, 1956. $0.50.

11819
THORIUM AND RARE-EARTH MINERALS IN POWDERHORN DISTRICT, GUNNISON COUNTY, COLORADO. J. C. Olson and S. R. Wallace. U. S. Geol. Survey Bull. 1027-O, 1956. 31p. 2 illus. $0.60(GPO)

Thorium has been found since 1949 in at leasd 33 deposits in an area 6 miles wide and 20 miles long in the Powderhorn district, Gunnison County, Colo. The district is underlain largely by pre-Jurassic metamorphic and igneous rocks, most of which, if not all, are pre-Cambrian in age. These rocks are overlain by sandstone of the Morrison formation of Jurassic age, and by volcanic rocks of the Alboroto group and the Hinsdale formation of Miocene and of Pliocene (?) age, respectively. The Th deposits occur in or near alkalic igneous rocks in which such elements as Ti, the rare-earth metals, Be, Sr, and Nb are present in greater-than-average amounts. The Th deposits, like the alkalic igneous rocks, have not been dated more precisely than pre-Jurassic. The Th deposits are veins and mineralized shear zones that range from a few inches to 18 ft wide and from a few ft to 3,500 ft long. At least part of the Th occurs as thorite or thorogummite. A small amount of what has been tentatively identified as xenotime is found in one deposit. Several minerals containing the rare-earth metals of the Ce group as major constituents are found in carbonate veins near Iron Hill. Bastnaesite and synchisite have been identified by x-ray methods, and cerite is probably present also. The fluorapatite in some veins and in parts of the mass of carbonate rock that occupies 2 sq miles in the central part of the Iron Hill composite stock contains rare-earth elements of the Ce group, generally in amounts of a fraction of a percent of the rock. The radioactivity of the deposits appears to be due almost entirely to Th and its daughter products. The ThO_2 content of selected high-grade samples from the Little Johnnie vein is as much as 4%, but in most veins is generally less than 1%, and is only from 0.05 to 0.1% in many of the veins studied. The Little Johnnie vein is a mineralized fault zone that ranges from less than 6 in. to 5 ft in width and can be traced discontinuously for a distance of more than 3,500 ft. The Th-bearing material occurs as irregular veinlets and thin films introduced along the fault zone. Near its west end the vein is broken by many faults in a zone that marks the edge of a roughly circular fault block, $1\frac{1}{2}$ miles in diameter, that has dropped 1,000 ft or more since the deposition of Miocene volcanic rocks that now floor the Milkranch Gulch basin. (auth)

11820
GEOLOGY AND MONAZITE CONTENT OF THE GOODRICH QUARTZITE, PALMER AREA, MARQUETTE COUNTY, MICHIGAN. R. C. Vickers. U. S. Geol. Survey Bull. 1030-F, 17p. and 2 illus. $0.50(GPO)

The Palmer area, which is on the south limb of the Marquette synclinorium, consists of a downfaulted block of Precambrian sedimentary rocks about 4 miles long and three-quarters of a mile wide. The block is composed mainly of middle Huronian Ajibik quartzite and Negaunee iron-formation and upper Huronian Goodrich quartzite. Monazite occurs in the Goodrich quartzite as rounded detrital grains concentrated mainly in the matrix of quartz pebble conglomerate which is interbedded with coarse-grained quartzite. Correlation of gamma-ray logs of drill holes which penetrate an apparent thickness of 1,100 feet of Goodrich quartzite and enter the underlying Negaunee iron-formation shows that most of the monazite occurs more than 300 ft above the base of the Goodrich quartzite. Drill-core specimens contain as much as 54 lb. of monazite per ton of rock. Outcrops of Goodrich quartzite, which are practically restricted to the lower 200 ft of the formation, contain an average of 2.9 pounds of monazite per ton. Samples from locally derived erratics contain as much as 110 lb. of monazite per ton. Laboratory work indicates that more than 85% of the monazite is recoverable by gravity methods after grinding and sizing. (auth)

11821
GEOLOGY AND ORE DEPOSITS OF THE FREELAND-LAMARTINE DISTRICT, CLEAR CREEK COUNTY, COLORADO. J. E. Harrison and J. D. Wells. U. S. Geol. Survey Bull. 1032-B. 98p. and 10 illus.

The Freeland-Lamartine district, in Clear Creek Co., Colo. forms a part of the Front Range mineral belt which is a northeastward-trending belt of co-extensive porphyry intrusive rocks and hydrothermal veins of Tertiary age. The geology and mineralogy of the district are discussed. The accessible mines were examined for radioactivity, and the dumps of inaccessible mines were explored with a scintillation counter. Secondary U minerals occur in vugs or along veins. In most of the radioactive material sampled, no discrete U minerals were identified. It is tentatively concluded that large areas containing only pyrite-Au veins are poor in U and that areas of pyrite-gold or galena-spalerite veins containing chalcopyrite are more favorable locations in which to explore for U deposits. (J.E.D.)

11822
INFERRED RELATIONSHIP OF SOME URANIUM DEPOSITS AND CALCIUM CARBONATE CEMENT IN SOUTHERN BLACK HILLS, SOUTH DAKOTA. Garland B. Gott. U. S. Geol. Survey Bull. 1046-A, 8p., 1956. $0.15 (GPO)

Evidence resulting from geologic mapping in the southern Black Hills indicates that the areas marginal to some of the larger carbonate-cemented sandstones are a favorable geochemical environment for the localization of uranium deposits. To determine whether these favorable environments are predictable, a limited experimental core-drilling program was carried out. An extensive deposit was discovered in an area marginal to a sandstone well-cemented with calcium carbonate. The deposit has not yet been developed, but from the available data it appears that

there is a significant quantity of mineralized rock present containing as much as 3.0 percent eU_3O_8. (auth)

11823

CONCENTRATION OF URANIUM IN SEDIMENTS BY MULTIPLE MIGRATION-ACCRETION. John W. Gruner. Econ. Geol. 51, 495-520(1956) Sept.-Oct.

The continual expansion of the areas in which uranium finds are being reported in sedimentary rocks makes the hypothesis that the metal was transported by solutions hydrothermal in origin entirely inadequate. Solutions, which originally by their very nature were concentrated, would have had to be dispersed over vast areas with exactly the opposite effect of that necessary to make workable deposits. Weathering and erosion of Precambrian granitic rocks in volumes of many thousands of cubic miles has occurred since Pennsylvanian time in the eight western states which make up our uranium province. If we add to these granites the small amounts of volcanic tuffs, the uranium contained in these rocks staggers the imagination, it being at least as large as 400 million tons and probably several times this figure. (auth)

11824

MARY KATHLEEN URANIUM DEPOSIT, MOUNT ISACLONCURRY DISTRICT, QUEENSLAND, AUSTRALIA. R. S. Matheson and R. A. Searl. Econ. Geol. 51, 528-40 (1956) Sept.-Oct.

The Mary Kathleen uranium deposit was discovered by prospectors in July, 1954, and extensive exploration activities since carried out have indicated sufficient reserves to warrant its projection as a mine. The investigations, which have been carried out, have led to the discovery of the additional deposits. The mineralization is epigenetic and related to granitic intrusion. The minerals consist of uraninite, rare-earth silicates and sulfide minerals occurring in a garnetized zone in a group of calc-silicate rocks of Lower Proterozoic age. The deposit is regarded as a replacement of high temperature origin, and it can be classed as a pyrometasomatic deposit. The deposit appears to be unique in being the first pyrometasomatic one where uraninite constitutes the chief economic mineral. The paper presents only a preliminary account of the geology and type of mineralization in the Mary Kathleen area, and it can be expected that more detailed papers describing different sections of the investigations will be prepared later. (auth)

11825

SOME CORRECTION FACTORS IN RADIOACTIVITY METHODS OF GEOLOGIC TIME MEASUREMENT. V. S. Venkatasubramanian (Indian Inst. of Science, Bangalore). J. Indian Inst. Sci. 38A, 153-8(1956) July.

The equations employed for the measurement of geologic time are considered for a general radioactive process. Modified expressions are derived to take account of the continued escape, or sudden removal of the parent or daughter elements. The case of the Pb^{207}/Pb^{206} method is also considered. (auth)

11826

RADIOACTIVE CONTENTS OF ROCKS AND MINERALS. V. Seetharam Aithal. J. Indian Inst. Sci. 38A, 159-62(1956) July.

The distribution of radioactivity in some rock and mineral samples was determined by alpha-activity measurements. A scintillation counter was used for estimating the radioactivity. The method of measurement is discussed. (auth)

11827

RATIO OF IONIUM TO URANIUM IN CORAL LIMESTONE. J. W. Barnes, E. J. Lang, and H. A. Potratz (Los Alamos Scientific Lab., N. Mex.). Science 124, 175-6(1956) July 27.

Samples of coral limestone cuttings taken over the first 200 ft in drilling on Elugelab island were analyzed for U by the NaF fluorimetric method and for Th^{230} by a radiochemical procedure which involves carrier-free separation of the total Th in the sample by thenoyltrifluoroacetone extraction and ion exchange techniques, followed by pulse analysis of the alpha activity in the separated Th. The Th^{230} content of the coral was found to vary with the depth in a fairly simple manner. The U content varied within narrower limits—2.9 to 5.5 ppm. Data obtained suggested that the magnitude of the Th^{230}–U ratio may indicate the age of the specimen. (J.E.D.)

11828

A DESCRIPTIVE GLOSSARY OF RADIOACTIVE MINERALS. Washington State Institute of Technology Bulletin 230—B Series. James W. Crosby, III. Pullman, State College of Washington, 1955. 148p.

11829

COFFINITE, A URANOUS SILICATE WITH HYDROXYL SUBSTITUTION: A NEW MINERAL. L. R. Stieff, T. W. Stern, and A. M. Sherwood (U. S. Geological Survey, Washington, D.C.). Am. Mineralogist 41, 675-88(1956) Sept.-Oct.

Difficulties in obtaining pure coffinite concentrates and the complete failure of repeated attempts to synthesize $USiO_4$ made it necessary to use a combination of indirect techniques in order to arrive at the chemical composition of coffinite. Heating, leaching, and alpha-plate studies combined with x-ray and semiquantitative spectrographic analyses strongly suggest the following: silica to U ratios are constant but insufficient to satisfy the formula $USiO_4$, As and V are not essential constituents of coffinite, the phase soluble in HNO_3 contains most of the U and 20 to 75% of the total silica in the coffinite-bearing specimen. Amorphous sexivalent U is not present, and the U is in the quadrivalent state. Coffinite has a distinctive x-ray-diffraction powder pattern of the zircon-type with $a_0 = 6.94$ A and $c_0 = 6.31$ A. The close similarity of the infrared absorption spectra of thorogummite, $Th(SiO_4)_{1-x}(OH)_{4x}$, and coffinite indicated that coffinite contains Si—O bonds in tetrahedral groups as well as bonded hydroxyl groups. Although no single line of evidence is sufficient to establish the identity and composition of this important U mineral of the unoxidized ores of the Colorado Plateau, all of the evidence taken together strongly supports the idea that coffinite is tetragonal with a zircon-type structure and has the formula $U(SiO_4)_{1-x}(OH)_{4x}$. (auth)

11830

PROSPEKTION VON URAN- UND THORIUMERZEN (PROSPECTING FOR URANIUM AND THORIUM ORES). G. Zeschke. Stuttgart, E. Schweizerbart'sche Verlagsbuchhandlung (Nagale u. Obermiller), 1956. 87p. (In German)

METALS AND METALLURGY

11831 AD-90140

Climax Molybdenum Co. of Michigan, Detroit.
OXIDATION-RESISTANT COATINGS FOR MOLYBDENUM. Progress Report for the Period October 1, 1955–December 30, 1955. J. R. Blanchard. 15p. Contract AF33(616)-2488.

Erosion and ductility tests were conducted with Mo specimens having single-layer, sprayed-metal coatings that had been considered outstanding in previous investigations. Ballistic impact and erosion tests were performed on Cr plated Mo specimens that had been prepared. Attempts were made to improve the thermal shock resistance of Colmonoy No. 5 alloy coating by mixing Mo powder

with the alloy for spraying. Mixtures containing 10 to 30% Mo were sprayed. Attempts were made to improve the ballistic impact resistance of the coating containing a Cr-Si alloy by using Colmonoy No. 5 alloy instead of Al as a binder for the Cr-Si alloy. Specimens of Mo were submitted to the National Bureau of Standards for electroplating with Ni-Cr. Trial specimens were submitted to Norton Company for spraying with fused Al oxide. The two groups of coated specimens will be evaluated at the Climax Molybdenum Company laboratory. A gas-fired muffle furnace for conducting oxidation tests at temperatures up to 3000°F has been designed, and construction has been initiated. (auth)

11832 AD-90747

Mallory-Sharon Titanium Corp., Niles, Ohio.

TITANIUM PROJECT. Progress Report for the Period January 1–February 29, 1956. Report No. 4. (Research Report No. 1000R112). Charles B. Dittmar and G. William Bauer. Mar. 6, 1956. 8p. Contract NOas-54-370-c.

The impact behavior of Mn–Ti alloy and Al–V–Ti alloys at several interstitial levels was investigated in the solution treated and aged conditions over the temperature range 100 to 1000°F. (F.S.)

11833 AECU-3298

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

DETERMINATION OF THE MECHANISM OF ROASTING BY KINETIC MEASUREMENTS. Technical Report No. XXIII. Milton E. Wadsworth. Mar. 1956. 30p. Project No. 1. Contract AT(11-1)-82. $4.80(ph OTS); $2.70 (mf OTS).

A brief application of absolute reaction rate theory to roasting and related metallurgical problems is presented. The importance of surface mass balance and concentration effects in linear oxidation are considered specifically. Examples of parabolic and logarithmic oxidation are given for the roasting of molybdenite. A general treatment of linear oxidation in terms of equilibrium and steady state adsorption is presented in some detail. (auth)

11834 FRDC/P-33

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.

THE ELEMENTS OF GROUPS IVA, VA, VIA AND BERYLLIUM—PHYSICAL AND MECHANICAL PROPERTIES. D. S. Oliver. May 29, 1953. 20p. (RDB(C)/TM-172).

A theoretical study has shown that the elements of groups IVA, VA, VIA and Be are most likely to withstand attack by U and Na–K alloys, and consequently are the most promising materials for use as fast reactor fuel element containers. The present memorandum is a summary of the physical and mechanical properties of these elements. It is a collection of numerical values which will assist in the comparison of different metals. The great difficulty experienced in the purification of these elements makes it unwise to regard the figures quoted as being applicable to the pure metals in every case. (auth)

11835 NAA-SR-1603

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

BASIC CHEMISTRY OF HIGH TEMPERATURE INORGANIC SYSTEMS. Semiannual Progress Report [For] July–December 1955. S. J. Yosim and T. A. Milne. Oct. 1, 1956. 17p. Contract AT-11-1-GEN-8. $0.20(OTS).

A program to study the high-temperature chemistry of Th has been initiated. The problems currently being studied are the vapor pressure of Th metal and the vapor pressure of ThF_4. It has been determined that the vapor pressure of ThF_4 varies from 0.73 to 7.10 mm. Hg at 1421 to 1549°K. A program to study the chemistry of metal–salt systems containing a common cation has also been initiated. Literature surveys have been made and experiments planned. (auth)

11836 NACA-TN-3816

Langley Aeronautical Lab., Langley Field, Va.

STATIC STRENGTH OF ALUMINUM-ALLOY SPECIMENS CONTAINING FATIGUE CRACKS. Arthur J. McEvily, Jr., Walter Illg, and Herbert F. Hardrath. Oct. 1956. 54p. Supersedes NACA-RM-L55D15A.

Seven configurations of specimens made of 2024 and 7075 aluminum-alloys in both rolled and extruded form were subjected to repeated axial loads until fatigue cracks of various lengths were formed. The specimens were then subjected to static tests to determine the residual static strength. Small cracks resulted in disproportionately large reductions of static strength, the reduction being greater for 7075 than for 2024 aluminum alloy. A simple method of analysis which predicts the observed results was developed and described. (auth)

11837 NAVORD-2038

Naval Ordnance Test Station, Inyokern, (China Lake), Calif.

ELEVATION OF CRITICAL TEMPERATURES IN STEEL BY HIGH HEATING RATES. W. J. Feuerstein and W. K. Smith. June 9, 1953. 17p. (NOTS-713; AD-15593).

The Ac_1 and Ac_3 critical temperatures were determined for AISI 1020, 1042, 1080, and 4130 steels in the annealed condition and also for the 4130 steel in two quenched and tempered conditions at heating rates from 30 to 2400°F/sec. The curves of critical temperatures vs. heating rate, plotted on semilog coordinates, do not indicate a straight-line relationship in this range of heating rates but rather show an increase in slope of the curves as heating rate is increased. A small tensile stress raised the Ac_1 and Ac_3 critical temperatures and resulted in plastic deformation when the specimen was heated or cooled through the critical temperature range. (auth)

11838 NP-6095

California. Univ., Berkeley. Minerals Research Lab.

THE SPECTRUM OF ACTIVATION ENERGIES FOR CREEP. Technical Report No. 47. John E. Dorn. Sept. 1, 1956. 36p. Contract N7-ONR-295.

Attention is focused on the complexities in the theory of creep and basic experimental procedures, that have proven to be better adapted for obtaining basic data on the fundamental laws of creep, are reviewed. Some progress is being made in uncovering the laws of creep in terms of the effect of temperature and stress on the creep rate. Additional experimental investigations will be required before the basic laws of creep are fully known. The major problem concerns the effect of substructures on creep. Older creep theories are being replaced by a more realistic theory to agree with known facts. (F.S.)

11839 NP-6096

Denver. Univ. Denver Research Inst.

RESEARCH ON HIGH TEMPERATURE PHYSICAL PROPERTIES. Progress Report No. 1 [for] July 1, 1956 to September 30, 1956. Richard D. Seibel and George L. Mason. Oct. 1, 1956. 16p. Project No. 6-(1-9964)-1252. Contract AF33(616)-3696.

In the initial quarter of this program, effort was expended in preparing designs of apparatus, selecting techniques, ordering equipment and materials, and construction of the experimental apparatus. Heat capacity is to be measured by dropping heated samples into an ice calorimeter. A comparative method is to be used for thermal conductivity. An electronic dilatometer is being built to measure the coefficient of thermal expansion. All tests will be made to the melting point of the material or to 3000°F, whichever is lower. The heat capacity furnace is

being built for eventual use up to 5000°F. All apparatus operates in high vacuum. (auth)

11840 NYO-7440

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.

FUNDAMENTAL STUDY OF THE EARLY STAGES OF SINTERING. Progress Report. F. N. Rhines, C. W. Spencer, and R. J. Knight. June 14, 1956. 18p. Contract AT(30-1)-1826. $3.30(ph OTS); $2.40(mf OTS).

The geometric changes occurring at the very beginning of sintering were studied. Very coarse atomized oxygen-free spherical porous Cu particles were sintered without compaction. After sintering, the fracture surface produced by breakage was observed, and measurements were made on polished sections through the sinterings. The number of contact points between powder particles, the growth of the weld areas, changes in specific volume, and particle surface area and curvature were observed. (F.S.)

11841 ORNL-2053

Oak Ridge National Lab., Tenn.

A LABORATORY FOR THE HIGH-TEMPERATURE CREEP TESTING OF METALS AND ALLOYS IN CONTROLLED ENVIRONMENTS. D. A. Douglas and W. D. Manly. Oct. 2, 1956. 34p. Contract W-7405-eng-26. $0.30(OTS).

Through the use of the equipment described, design information similar to the curves shown was obtained for a number of materials, over a wide range of temperatures, and in many different environments. The reliability of the data obtained in the gaseous and vacuum type of creep machines compares favorably with that obtained from the conventional apparatus used for testing in air. The data obtained in the liquid-metal test units show considerable scatter at 0.5% strain and below. This equipment should be modified to improve the sensitivity of the extensometer system for the measurement of strains of less than 1.0%. A program of preventive maintenance has ensured uninterrupted operation of the temperature-controlling instruments. The records indicate that for the vacuum and gaseous test machines during the past four years only 2.0% of the available testing time that was lost was due either to the necessary disassembly of completed tests and initiation of new tests or to maintenance and repair. About 5.0 to 7.0% of the available testing time was lost in the operation of the liquid-metal test machines. (auth)

11842 SO-2048

General Electric Co. Research Lab., Schenectady, N. Y.

FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY. Thirty-first Quarterly Report. (Progress Report No. 48). R. E. Hoffman, R. A. Oriani, and D. Turnbull. Oct. 5, 1956. 4p. Contract W-31-109-Eng-52. (96-RL-1645). $1.80(ph OTS); $1.80(mf OTS).

The methods to be used to attempt to detect preferential grain boundary and dislocation diffusion of carbon into α-iron are described. Preliminary results on the operation of the differential solution calorimeter and reaction calorimeter are reported. (auth)

11843 TID-3301

Technical Information Service Extension, AEC.

WELDING AND BRAZING: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. July 1956. 32p. $0.25(OTS).

Selected unclassified reports, supplementing those abstracted in TID-3059, which were available in TISE files on July 1, 1956, on welding and brazing of materials of interest to nuclear technology, such as Al, Be, Hf, Mo, Th, Ti, Zr, stainless steels, high-temperature alloys, pressure vessels, and heat exchangers, are annotated. Author, subject, and report-number indexes are included. 127 references. (auth)

11844 TID-5365

Division of Organization and Personnel. Safety and Fire Protection Branch, AEC.

ZIRCONIUM FIRE AND EXPLOSION HAZARD EVALUATION. Interim Report. Aug. 7, 1956. 29p.

Recent developments from attempts to reappraise metallic Zr hazards are reported. Three categories for Zr incidents are set up and the incidents in each category described. Mechanism theories, hazard evaluations, and recommended action for minimizing hazards are given. (T.R.H.)

11845 WADC-TR-54-231(Pt. 1)

Stanford Research Inst., Menlo Park, Calif.

DEVELOPMENT OF NONDESTRUCTIVE TESTS FOR STRUCTURAL ADHESIVE BONDS. J. S. Arnold. Oct. 1954. 66p. Contract AF33(616)-2035. (AD-52664).

Research was done on the use of sonic methods for the non-destructive evaluation of metal-to-metal adhesive bonds. No aspect of the low frequency behavior (less than 15,000 cps) has been found to be indicative of joint strength. Techniques utilizing high frequency impedance measurements as provided by mechanical driving systems, and steady displacements produced by the application of vacuum cups, have been developed. These techniques show sufficient correlation between bond strength and measurable parameters to justify further investigation, and one or more of them may ultimately provide a satisfactory solution to the non-destructive test problem for adhesive bonds. (auth)

11846 WAPD-TM-14

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

A PRELIMINARY STUDY OF THE PYROPHORIC PROPERTIES OF ZIRCONIUM MACHININGS AND STANDARD WARNING LABELS FOR ZIRCONIUM. W. W. Allison. Sept. 1956. 13p. Contract AT-11-1-GEN-14. $0.20(OTS).

The pyrophoric properties of various forms of scrap metal resulting from the machining of tons of Zr were superficially studied for a two-fold purpose: to obtain some immediate rules of thumb and some indications of possible lines for fruitful research. Certain scrap size characteristics, previously undefined, were noted in regard to the pyrophoric properties. An attempt to classify and label scrap by sizes relative to their hazards was made. The present labeling is too broad, inadequate, and ill-defined to designate properly the hazardous from the less hazardous and nonhazardous forms of Zr metal. A suggested revision was proposed. A system of Standard Warning Labels for Zr was adopted by Bettis Plant and is proposed as a standard for the Zr industry. (auth)

11847 AERE-Lib/Trans-586

NEW RESULTS ON THE ELECTROLYSIS OF SOLID METALLIC PHASES. H. Weyer and W. Seith. Translated by N. Willis from Z. Elektrochem. 59, 942-6(1955). 13p.

In the electrolysis of the solid β phase of the Cu–Al system, in addition to the already well-known relative transport, a common transport of both metals towards the anode has been established. In contrast with this, a common transport of both metals towards the cathode occurs in the case of the newly investigated γ phase. As the β phase is an electron conductor, whereas the γ phase is a defect-electron conductor, it is clear that a relation exists between the conduction mechanism and the transport. As a tentative explanation of the common transport phenomenon, a preferred mutual exchange between charge carriers and defect (i.e. movable) lattice building units is postulated.

It is shown that the magnitude of the common transport in the β-phase diminishes with increasing current density. (auth)

11848

URANIUM PURIFICATION BY ELECTROREFINING. Leonard W. Niedrach and Arthur C. Glamm (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Electrochem. Soc. 103, 521-8(1956) Sept.

The feasibility of a high-temperature electrorefining process for decontamination of U from associated fission products was demonstrated. Low-melting alloys of U with Ni were used to obtain molten products at temperatures below the melting point of pure U. Effects of temperature, current, and salt-bath composition on cell efficiency and cell operation are discussed. (auth)

11849

EFFECT OF IMPURITIES ON THE HARDNESS OF TITANIUM. T. D. McKinley (E. I. du Pont de Nemours & Co., Wilmington, Del.). J. Electrochem. Soc. 103, 561-7(1956) Oct.

The individual effects of 15 impurities on the as-cast hardness of Ti buttons prepared under reproducible conditions have been determined. The data presented allow the estimation of O_2 in unalloyed Ti from a hardness measurement and a few conventional chemical analyses with an error of less than 10% from the value as determined by vacuum fusion analysis. (auth)

11850

OXIDATION OF ALLOYS INVOLVING NOBLE METALS. Carl Wagner (Massachusetts Inst. of Tech., Cambridge). J. Electrochem. Soc. 103, 571-80(1956) Oct.

Diffusion processes during the oxidation of alloys involving noble metals are analyzed theoretically. An oxide film of uniform thickness is stable only if diffusion in the alloy is relatively rapid compared with diffusion in the oxide of the less noble metal. Otherwise, there is the tendency to form a rugged alloy-oxide interface. The oxidation rate is calculated for the limiting case of a scale consisting of protruding sections of the oxide of the less noble metal interspersed with slender trunks of alloy rich in the more noble metal. Under these conditions, the oxidation rate of alloys containing up to 50% of noble metal is supposed to be of the same order of magnitude as the oxidation rate of the less noble metal in its pure state. (auth)

11851

THE TWO-STEP ANNEAL OF COLD-WORKED α-BRASS AND SILVER–ZINC. A. C. Damask (Frankfort Arsenal, Philadelphia). Acta Met. 4, No. 2, 215-17(1956).

It was concluded from the resistivity behavior and related data that short-range order occurs in α brass and that small changes in the degree of order cause the resistivity to change. Cold-work can be expected to destroy short-range order, and the time and temperature required to restore it to the equilibrium value at the temperature of anneal can be determined. The similar behavior of cold-worked silver–zinc permits the conclusion that short-range order also occurs in that alloy, is destroyed by cold-work, and can be restored by an anneal at a temperature lower than that required for recrystallization. (auth)

11852

THE SURFACE TENSIONS OF LIQUID-METAL SOLUTIONS. J. W. Taylor (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Met. 4, 460-8 (1956) Sept.

Two analytical methods are presented for the calculation of the surface tensions of binary liquid-alloy mixtures. Calculated surface tension-composition relationships are compared with the corresponding experimental values for ten binary systems. For six simple eutectic systems the agreement is good. Three systems, showing intermediate phase formation in the solid state, exhibited considerable discrepancies between the calculated and experimental relationships. It is suggested that in these systems the surface has not the simple monolayer structure assumed in the analysis. In one system of peritectic form, the agreement was intermediate between the above two extremes. It was not found possible to invert the analysis to calculate activity-composition relationships from surface tension data, although this is theoretically possible. (auth)

11853

ELECTROLYTIC TITANIUM. M. E. Sibert and M. A. Steinberg (Horizons Inc., Cleveland). J. Metals 8, 1162-8 (1956) Sept.

On the basis of available information, it would appear that the process type with the greatest commercial potential for producing Ti would be a halide process. Both fluoride and chloride types offer advantages and also possess areas where further development could be done to assure them a more competitive position with present methods. It is doubtful that oxide processes can be utilized as direct production methods, although they might be utilized to provide starting materials for a refining procedure. The basic criteria governing the success of any such process will be quality of material and net cost of the product. On the basis of present costs, both K_2TiF_6 and $TiCl_4$ would not be too attractive as starting materials unless substantial reductions could be effected in their processing costs. However, in an efficient straightforward electrolytic process, it is possible that a sufficiently economical operation could be achieved so as to offset the materials cost. A successful electrolytic procedure will likely be a continuous or semi-continuous one, since the equipment required will probably be somewhat unconventional (i.e., use inert atmospheres, facilities for high-temperature handling of molten salts, etc.) and frequent shutdowns would be undesirable. (auth)

11854

BASAL PLANE DEVELOPMENT IN ELECTRODEPOSITED HEXAGONAL-CLOSE-PACKED METALS: ZINC, TITANIUM, AND ZIRCONIUM. W. R. Opie (National Lead Co., South Amboy, N. J.). J. Metals 8, 1192-4(1956) Sept.

The manner in which typical electrodeposits of hexagonal-close-packed metals—zinc, titanium and zirconium—tend to form is discussed. The conditions of electrodeposition markedly affect the nature of the deposits in regard to crystal size, orientation, and appearance. No attempt is made to correlate cell conditions with deposit quality but, rather, characteristic types of deposits were slected and a study made to show the relationship between outward appearance and crystal structure. The zinc deposits were made in aqueous electrolytes and the titanium and zirconium deposited from fused salt baths. (auth)

11855

OXYGEN IN LIQUID IRON–NICKEL ALLOYS. Henry A. Wriedt and John Chipman (Massachusetts Inst. of Tech., Cambridge). J. Metals 8, 1195-9(1956) Sept.

Equilibrium in the reaction of hydrogen gas with oxygen in liquid nickel, iron, and their alloys has been studied at temperatures of 1500 to 1700°C. The equilibrium constant, p_{H_2O}/p_{H_2} [% O], is greater in nickel than in iron by a factor of 45 at 1594°C. In the alloy steel range, the activity coefficient of oxygen is slightly increased by the presence of nickel. (auth)

11856

VALIDITY OF TIME-COMPENSATED TEMPERATURE PARAMETERS FOR CORRELATING CREEP AND CREEP-RUPTURE DATA. F. Garofalo (U. S. Steel Corp., Kearny,

N. J.), G. V. Smith (Cornell Univ., Ithaca, N. Y.), and B. W. Royle (U. S. Steel Corp., Cleveland, Ohio). Trans. Am. Soc. Mech. Engrs. 78, 1423-34(1956) Oct.

Several time-compensated temperature parameters, which were proposed as dependent only on the initial stress, are discussed with relation to time of creep rupture and to minimum and average creep rates. The so-called master "curve" is discussed in terms of experimentally determined relationships. In checking the validity of the proposed parameters, using experimental results for several ferritic and austenitic steels, it is found that these parameters are not single-valued functions of the initial stress over wide ranges in stress, and the existence of a master curve for these parameters is doubtful. (auth)

11857

STRUCTURAL STABILITY OF MODIFIED 12-CHROMIUM ALLOYS. W. C. Hagel and E. F. Becht (General Electric Co., Schenectady, N. Y.). Trans. Am. Soc. Mech. Engrs. 78, 1439-46(1956) Oct.

In addition to possessing an attractive combination of mechanical properties for turbine applications, certain modified 12-Cr alloys were found to be structurally stable after long-time static aging and service exposure at high temperatures. However, two precipitation reactions have been observed to occur unpredictably in 12 Cr–Co–W–V alloy. The precipitating phases have been identified, and their effects upon mechanical properties are reported. After about 200 hr at 800 to 950°F (445 to 510°C), precipitation of Cr-rich ferrite causes decreased impact resistance and increased hardness; after about 6000 hr under stress at 950 to 1200°F (510 to 650°C), sigma formation causes an extreme decrease in impact resistance and no significant increase in hardness. (auth)

11858

PREPARATION, IDENTIFICATION CHEMICAL PROPERTIES OF THE THORIUM SILICIDES. E. L. Jacobson, Robert D. Freeman, A. G. Tharp, and Alan W. Searcy (Purdue Univ., Lafayette, Ind. and Univ. of California, Berkeley). J. Am. Chem. Soc. 78, 4850-2(1956) Oct. 5.

An x-ray diffraction investigation of the Th–Si system establishes the existence of "β–$ThSi_2$," ThSi, and Th_3Si_2 in addition to α–$ThSi_2$ which has been previously reported. "β–$ThSi_2$" is hexagonal, space group D^1_{6h}–P6/mmm, with $a_0 = 3.985 \pm 0.002$ A and $c_0 = 4.220 \pm 0.002$ A. The phase contains a higher ratio of Th to Si atoms than does α–$ThSi_2$ and apparently has a real composition of about $ThSi_{1.5\pm0.2}$ ThSi is orthorhombic, space group D^{16}_{2h}–Pbnm, with $a_0 = 5.89$A, $b_0 = 7.88$ A, and $c_0 = 4.15$ A. Th_3Si_2 is primitive tetragonal, space group D^5_{4h}–P4/mbm, with $a_0 = 7.835 \pm 0.003$ and $c_0 = 4.154 \pm 0.005$ A. These phases are isomorphous with corresponding uranium silicides. Reactivities of the thorium silicides with twelve common chemical reagents are reported. (auth)

11859

IMPROVED ELEVATED TEMPERATURE STRENGTH. R. A. Lula, A. J. Lena, and H. M. Johnson (Allegheny Ludlum Steel Corp., Brackenridge, Penna.). Chem. Eng. 63, No. 10, 236, 238, 240 & 242(1956) Oct.

Results of the cold working of austenitic stainless steels indicate that the structural modifications which occur as a result of recrystallization are harmful to high-temperature strength regardless of whether or not recrystallization occurs during the test or prior to testing. These microstructural changes include a refinement in grain size and modification of carbide precipitation in the steels and accelerated sigma formation during recrystallization in 310 steel. (auth)

11860

NEUTRON DIFFRACTION STUDY OF TITANIUM–ZIRCONIUM SYSTEM. S. S. Sidhu, LeRoy Heaton, D. D. Zauberis, and F. P. Campos (Argonne National Lab., Lemont, Ill.). J. Appl. Phys. 27, 1040-2)1956) Sept.

Titanium and zirconium alloy system consists of a continuous series of random substitutional solid solutions of solvent and solute atoms. Titanium scatters thermal neutrons in the opposite phase from those scattered by Zr, the scattering amplitudes being: $b_{Ti} = -0.38 \times 10^{-12}$ cm and $b_{Zr} = 0.62 \times 10^{-12}$ cm. An alloy containing 62 at.% Ti, and 38 at.% Zr is developed that gives no coherent scattering reflections in its neutron diffraction pattern, and is extremely useful in constructing devices in which scattering of thermal neutrons is not desired. Based on negative and positive scattering amplitudes of different isotopes of the same element for thermal neutrons, development of isotopic alloys is suggested. (auth)

11861

METAL POWDER ROLLING—A NEW FABRICATION TECHNIQUE. Samuel Storchheim (Glenn L. Martin Co., Baltimore). Metal Progr. 70, No. 3, 120-6(1956) Sept.

11862

HIGH-VACUUM METALLURGY. GROWING IMPORTANCE IN THE NUCLEAR FIELD. Nuclear Eng. 1, 252-4(1956) Sept.

The importance, techniques, and types of furnaces used in high-vacuum metallurgy are discussed. (F.S.)

11863

AN X-RAY STUDY OF ORDERING PROCESSES IN CuAu SINGLE CRYSTALS. Makoto Hirabayashi and Shiro Ogawa (Tohoku Univ., Sendai, Japan). J. Phys. Soc. Japan 11, 907-14(1956) Sept.

Ordering processes in the CuAu alloy were studied by x rays using single crystals. Characteristic diffuse scattering effects, which may be regarded as similar phenomena to those in the partially ordered CoPt alloy, were observed at early stages of the ordering. The change in x-ray-diffraction pattern during aging was discussed on the basis of kinetics of the ordering reaction. (auth)

Refer also to abstracts 11708, 11884, and 11885.

PHYSICS

11864 AD-88135

Library of Congress. Technical Information Div., Washington, D. C.

CASTING TECHNIQUES FOR EXPLOSIVES AND OTHER NONMETALLIC MATERIALS: [A BIBLIOGRAPHY]. Thomas C. Goodwin, Jr.—Mauree W. Ayton, ed. Jan. 1956. 56p.

The bibliography on casting techniques for nonmetals includes references, with annotations, to pertinent published literature on the subject issued from 1910 through 1954 which have been found by a systematic search of the sources listed. The material included in the bibliography pertains to various casting methods for reducing shrinkage after loading nonexplosives (glass, ceramics, rubber, cement) or explosives in the molten state. In general, references to apparatus or methods previously described are not included. References on compositions of the cast material were considered pertinent only in cases where experiments were concerned with loading procedures. A few references to metals are included which describe new casting procedures. (auth)

11865 AD-89698

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF A HIGH TEMPERATURE IMPREGNANT. Final Report. A. G. Metcalfe and Cord H. Sump.

Nov. 1, 1955. 69p. ARF Project No. B 072.

Two high-temperature impregnants have been developed. One is based on a powder mixture which can be fused to form a molten alloy in situ, and the other is based on a modified thermite reaction which is set off inside the pores after impregnation. A vacuum and pressure impregnation apparatus was built for this study. Powder metal discs were used for porous standards and were evaluated by means of their permeabilities. D'Arcy coefficients of over 2000×10^{-12} cm^2 for dry air were reduced to less than 0.1×10^{-12} cm^2 after a single impregnation. In many cases, no flow could be detected at 80 psi. These values were better than those achieved with one widely used industrial impregnant. (auth)

11866 ISC-654

Ames Lab., Ames, Iowa.

MEASUREMENT AND SIGNIFICANCE OF TRANSPORT NUMBER IN FUSED SALTS. Richard W. Laity and Frederick R. Duke. June 1955. 70p. Contract W-7405-eng-82. $0.40(OTS).

The concept of transport numbers in fused salts is discussed in the light of the inapplicability of the usual definition applied to electrolytic solutions. The lack of a solvent reference frame, with respect to which the mobilities of the ions are normally compared, necessitates employment of a microscopic definition, if the conductance of a molten electrolyte is to be divided into a sum of meaningful ionic conductances. Thus, the reference frame selected here consists of the large bulk of ions not involved in the conductivity process at any given instant, i. e., those ions which lack the necessary energy of activation for migration. The transport numbers are therefore the fractions of current carried by the migrating ions during electrolysis as measured with respect to this frame. (auth)

11867 NP-6098

Shell Development Co., Emeryville, Calif.

AN INVESTIGATION OF GREASE LUBRICATION PHENOMENA IN OPEN, SHIELDED AND SEALED ANTI-FRICTION BEARINGS. (Cover carries title: GREASE LUBRICATION OF HIGH SPEED ANTI-FRICTION BEARINGS). Quarterly Progress Report No. 7 for March through May 1956. John B. Accinelli and Stewart J. Beaubien. 40p. Contract AF33(616)-2443. (S-13691).

A study was made of the lubrication problems of ball bearings in a system in which the operating conditions can be controlled. A 20-mm ultra high speed ball bearing rig was designed and constructed for controlling the operation. (auth)

11868 AEC-tr-2565

THE CONDUCTIVITY OF FILMS IN A LONGITUDINAL MAGNETIC FIELD. M. Ya. Azbel. Translated from Doklady Akad. Nauk S.S.S.R. 99, 519-22(1954). 6p.

A mathematical treatment of the effective conductivity of metallic films in a longitudinal, constant, magnetic field parallel to the electrical field is given. (T.R.H.)

11869 AEC-tr-2566

THE INTERACTION OF SHOCK WAVES WITH TANGENTIAL AND WEAK DISCONTINUITIES. S. P. Dyakov. Translated from Doklady Akad. Nauk S.S.S.R. 99, 921-3 (1954). 4p.

The classification of the possible configurations within the framework of the plane stationary problem in cases of shock wave interactions with tangential and weak discontinuities is treated. (T.R.H.)

11870 AEC-tr-2576

SIMILAR TRAJECTORIES FOR CHARGED PARTICLES IN MAGNETIC FIELDS. V. M. Kelman and K. V. Liubimov. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 18, 155-60(1954). 7p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-4799. (T.R.H.)

11871 AEC-tr-2583

MAGNETIC ROTATION OF THE POLARIZATION PLANE FOR CENTIMETER WAVES. A. L. Mikaelyan. Translated from Uspekhi Fiz. Nauk 51, 205-51(1953). 34p.

The background and theory of magnetic rotation of the polarization plane is reviewed, special consideration being given to magnetic resonance and wave propagation in ferromagnetic materials. The developed theory is compared with experimental observations. Equations are also developed for describing plane rotation in artificial dielectrics and electronic plasma. (D.E.B.)

11872 AEC-tr-2590

REFLECTION OF SHOCK WAVES FROM CORNERS OF RIGID WALLS. A. Ya. Sagomonian. Translated from Vestnik Moskov. Ser. Fiz. Mat. i Estestven. Nauk, No. 2, 33-40(1955). 10p.

The problem of determining the parameters of a gas behind the reflected shock wave which is formed when a plane wave of any intensity meets the vertex of a corner between two rigid walls is investigated. An approximate solution is found, and the formulas so derived have simple forms. If the angle between the two walls is close to 180°, then the influence of the corner on the perturbed region of the gas behind the reflected shock wave is insignificant. In this case, for the description of the motion in the region where the influence of the apex is felt (diffraction by the corner), linearized equations of nonstationary gas motion may be used. (auth)

11873 AEC-tr-2623

LETTER TO THE EDITOR—RE: EQUATIONS FOR THE OSCILLATIONS OF UNIFORM ELECTRON CURRENT. (Appeared in Zhur. Tekh. Fiz. 22, No. 9 (1952)). Yu. A. Katzman. Translated from Zhur. Tekh. Fiz. 24, 1359-60 (1954). 3p.

It is shown that the basic function of the positive ion is maintenance of uniformity of the electron current. (T.R.H.)

11874

THERMAL BEHAVIOR OF AMORPHOUS ICE. J. A. Ghormley (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 25, 599(1956) Sept.

Experiments on the warming of noncrystalline ice show heat evolution below –129°C (the previously reported crystallization temperature) and a higher heat of crystallization (15.8 cal/g) than previously reported (2 to 7 cal/g). (T.R.H.)

11875

KINEMATOGRAPHIC STUDY OF TENSILE FRACTURE IN POLYMERS. A. M. Bueche and A. V. White (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 27, 980-3(1956) Sept.

High speed motion pictures were taken of silicone rubber, irradiated polyethylene, Plexiglas II, and aluminum foil while they were being broken. Fractures started internally in some of the silicone samples but at the edges of all of the others. The rates of crack growth and the rates of retraction of the ends of the rubber samples were measured. The velocities with which the cracks grew were compared with the results of others. Their prediction, that the velocities should be about one half those of transverse waves in the media, was found to represent the data for materials with moduli differing by five decades. After fracture, the ends of the rubber samples contracted with velocities approximately equal to the velocities of longitudinal waves in these samples. (auth)

11876

PHOTOGRAPHIC FILM WASHER. David C. Manning and

W. O. Phillips (Goodyear Atomic Corp., Portsmouth, Ohio). Spectrochim. Acta 8, 54-5(1956) June.

A specifically designed 35-mm film washer of simple glass construction is described. It provides thorough removal of undesired chemicals from the photographic emulsion. (auth)

11877

THE ACCURACY OF PARTICLE SIZE DETERMINATION BY CUMULATIVE SEDIMENTATION METHODS. J. K. Donoghue (Simon-Carves Ltd., Stockport, England). Brit. J. Appl. Phys. 7, 333-6(1956) Sept.

Cumulative methods of particle size analysis are sometimes alleged to be inaccurate because it is necessary to differentiate the sedimentation curve in order to evaluate the size distribution. By considering a hypothetical distribution it has been shown that, provided sufficient points are obtained to enable the sedimentation curve to be plotted accurately, this differentiation does not give rise to errors. Comparative tests with the microscope and sedimentation balance on two samples composed of spherical particles confirm this conclusion. (auth)

11878

CHARACTERISTICS OF POROUS BEDS AND STRUCTURES. R. B. MacMullin and G. A. Muccini. A.I.Ch.E. Journal 2, 393-403(1956) Sept.

The correlation of viscous-flow permeability and electrical conductivity of porous media are reported. Such a correlation is believed to be of interest and importance in civil, geological and mining, chemical, and electrochemical engineering and in medicine and biochemistry. (J.E.D.)

ASTROPHYSICS

11879

CALIFORNIUM-254 AND SUPERNOVAE. G. R. Burbidge and F. Hoyle (Carnegie Institution of Washington, D.C. and California Institute of Tech., Pasadena) and E. M. Burbidge, R. F. Christy, and W. A. Fowler (California Inst. of Tech., Pasadena). Phys. Rev. 103, 1145-9(1956) Sept. 1.

It is suggested that the spontaneous fission of Cf^{254} with a half life of 55 days is responsible for the form of the decay light-curves of supernovae of Type I which have an exponential form with a half life of 55 nights. The way in which Cf^{254} may be synthesized in a supernova outburst, and reasons why the energy released by its decay may dominate all others are discussed. The presence of Tc in red giant stars and of Cf in Type I supernovae appears to be observational evidence that neutron capture processes on both a slow and a fast time-scale have been necessary to synthesize the heavy elements in their observed cosmic abundances. (auth)

COSMIC RADIATION

11880 AFCRC-TN-56-200

Cambridge Research Center. Atmospheric Physics Lab., Bedford, Mass.

EFFECTS OF THE PRIMARY COSMIC RADIATION ON MATTER. Air Force Surveys in Geophysics No. 78. Harold Curtis. Jan. 1956. 25p.

A survey of the present knowledge of the primary cosmic radiation is presented. The data on the flux of particles as functions of energy, latitude, altitude and chemical type have been reproduced in a consistent set of units. The effects of the exposure of materials to this radiation in terms of the produced ionization are predicted. (auth)

11881

THE DETECTION OF CHLORINE-39 IN RAIN WATER. L. Winsberg (Weizmann Inst. of Science, Rehovot). Bull. Research Council Israel 5A, 143-9(1956) Jan.-Apr.

The discovery of Cl^{39} in rain water offers a new means of studying problems in cosmic radiation and meteorology. For this purpose it is necessary to make meteorological measurements and improve the method of sample collection, chemical purification, and counting. Suggestions along this line are given. (auth)

11882

MODULATION OF PRIMARY COSMIC-RAY INTENSITY. Eugene N. Parker (Univ. of Chicago). Phys. Rev. 103, 1518-33(1956) Sept. 1.

It is assumed that the cosmic-ray particles observed at the earth are of galactic origin, except for the occasional bursts from solar flares. With this interpretation, the 11-year variation of the cosmic-ray intensity and the Forbush decreases represent depressions of the steady galactic intensity. The observed rigidity dependence of the depression indicates that magnetic fields are responsible. A quantitative investigation of the possible motion and configuration of magnetic fields capable of producing the observed effects is carried out. It is shown that, within the limitations imposed by what is thought to be known today of the galactic magnetic field, of solar activity, and of interplanetary cloud model, modulating the galactic cosmic-ray intensity throughout the solar system. It is proposed that the modulation of the intensity is produced locally, within a few earth's radii, by interplanetary magnetic gas clouds captured by the terrestrial gravitational field. Such a model seems to produce the observed effects on the basis of the known facts about solar activity. The most straightforward test of this geocentric model, independent of inferences from cosmic-ray effects, is the question of whether the absorption of the captured magnetic hydrogen gas can be detected as a narrow line in the center of the broad solar L_α emission line. (auth)

11883

BERYLLIUM-10 PRODUCED BY COSMIC RAYS. James R. Arnold (Princeton Univ., N. J.). Science 124, 584-5 (1956) Sept. 28.

The isolation and identification are reported of Be^{10}, a β-emitter of half-life 2.5×10^6 years, produced by cosmic bombardment of atmospheric nitrogen and oxygen. Deep-sea bottom sediment was examined for the presence of Be^{10} removed from the atmosphere by rain. Methods of preparing the samples and counting methods are described. (C.H.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

11884 NP-6105

Rensselaer Polytechnic Inst., Troy, N. Y.

CREEP BEHAVIOR OF MAGNESIUM AND MAGNESIUM ALLOY SINGLE CRYSTALS AT ROOM AND ELEVATED TEMPERATURES. Final Report [for] July 1, 1954 to June 30, 1956. Dept. of Metallurgical Engineering. W. F. Sheely and R. R. Nash. Aug. 31, 1956. 106p. Contract DA-30-115-ord-549.

A technique was developed with which Mg single crystals could be creep tested with a shear stress applied directly to the operating slip plane. The response of basal slip to a constant applied stress was studied at room and elevated temperatures and under several stresses. Transient creep was observed in all cases and the results were analyzed on the basis of an activated rate process. The influence of time and stress changes were studied and a model was proposed by which the observed phenomena could be explained. The influence of surface films was briefly ex-

plored and some observations on an elastic recovery were included. (auth)

11885
CRYSTAL STRUCTURES OF LITHIUM–MAGNESIUM ALLOYS AT LOW TEMPERATURES. C. S. Barrett (Univ. of Chicago). Acta Met. 4, 528-31(1956) Sept.

The crystal structures of Li-rich Li–Mg alloys uniquely offer the possibility of testing theories of the influence of valence-electron concentration on hexagonal axial ratio in the range 1.0 to 1.16 electrons per atom. The body-centered cubic phase at 78°K has a_0 = 3.475 A for Li + 13.4 atomic per cent Mg and 3.474 for 19.7 atomic per cent Mg, and the face-centered cubic phase at 78°K resulting from cold work has a_0 = 4.381 and 4.375 A respectively for the same compositions. The phase appearing on simple cooling was fully accounted for as close-packed hexagonal with stacking faults and with a and c lattice dimensions at 78°K as follows, respectively, for the atomic per cent Mg compositions listed: 4.6%, 3.099, 5.074 A; 8.8%, 3.098, 5.063; 12.5%, 3.110, 5.079 and 3.107, 5.073; 13.4%, 3.098, 5.073 and 3.098, 5.073; 16.3%, 3.104, 5.083. Distortion of c/a to less than 1.633 by stresses, proposed by Goodenough, was observed in none of the alloys; the mean axial ratio was 1.6356. Difficulties of developing a quantitative theory are pointed out. (auth)

11886
OBSERVATIONS OF DISLOCATION GLIDE AND CLIMB IN LITHIUM FLUORIDE CRYSTALS. J. J. Gilman and W. G. Johnston (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 27, 1018-22(1956) Sept.

It is shown that reagent CP-4 + Fe^{3+} can be used to detect the positions of dislocations in LiF crystals. The technique is highly selective and both edge and screw (110) [1$\bar{1}$0] dislocations can be detected and distinguished. A double etching method is used to observe, for the first time, the glide and climb of individual dislocations in LiF. (auth)

ELECTRICAL DISCHARGE

11887 NYO-6486 MH-I
New York Univ., New York. Atomic Energy Commission Computing Facility.
GENERAL FLUID EQUATIONS. Magneto-Hydrodynamics Note No. I. Harold Grad. Aug. 1, 1956. 18p. Contract AT(30-1)-1480. $3.30(ph OTS); $2.40(mf OTS).

Notes on general fluid equations in electromagnetic fields are presented. Notation, various forms of fluid conservation equations, charge and current, and entropy are included in the discussion. (J.H.M.)

11888 NYO-6486 MH-II
New York Univ., New York. Atomic Energy Commission Computing Facility.
DIMENSIONAL CONSIDERATIONS. PART 1. Harold Grad. PART 2. Marian H. Rose. Magneto-Hydrodynamics Note No. II. Aug. 7, 1956. 23p. Contract AT(30-1)-1480. $4.80(ph OTS); $2.70(mf OTS).

A qualitative discussion is presented of the extent and magnitude of magneto-hydrodynamic phenomena by the elementary means of counting dimensionless parameters. Topics such as basic equations, fundamental units, the comparison of terms in Maxwell's equations, and the comparison of terms in current and energy equations are discussed. (J.H.M.)

11889 NYO-6486 MH-III
New York Univ., New York. Atomic Energy Commission Computing Facility.
SPECIAL SOLUTIONS. Magneto-Hydrodynamics Note No. III. Harold Grad. Aug. 14, 1956. 15p. Contract AT(30-1)-1480. $3.30(ph OTS); $2.40(mf OTS).

Mathematically simple flows which are explicitly solvable and are chosen to exhibit certain basic properties of plasmas are considered. Gyro and plasma oscillations are included. Elementary properties of the Debye shielding length, Lamar radius, and another quantity termed "magnetic shielding" length are discussed. (J.H.M.)

11890 NYO-6486 MH-IV
New York Univ., New York. Atomic Energy Commission Computing Facility.
OHM'S LAW. Magneto-Hydrodynamics Note No. IV. Harold Grad. Aug. 20, 1956. 25p. Contract AT(30-1)-1480. $4.80(ph OTS); $2.70(mf OTS).

The formal nature and domain of validity of Ohm's law are considered. Topics such as qualitative considerations, formal analysis, and heuristic considerations are included. (J.H.M.)

11891 NYO-7691
New York Univ., New York. Atomic Energy Commission Computing Facility.
ON THE DIFFUSION OF A CONDUCTING FLUID ACROSS A MAGNETIC FIELD. Marian H. Rose. July 1, 1956. 11p. Contract AT(30-1)-1480. $3.30(ph OTS); $2.40 (mf OTS).

Concepts upon which diffusion theory is based were examined, and the rate of diffusion of a conducting fluid across a magnetic field was shown to be independent of the field if proper scaling is used. (F.S.)

11892 AEC-tr-2558
CONCERNING METHODS FOR INVESTIGATING DISTRIBUTION FUNCTIONS OF VELOCITIES OF ELECTRONS IN A GASEOUS DISCHARGE. Yu M. Kagan, V. L. Fedorov (Federov), G. M. Malyshev, and L. A. Gavallas. Translated from Doklady Akad. Nauk S.S.S.R. 76, 215-17(1951). 4p.

The electron-velocity distribution function involves the second derivative of probe current vs. probe potential. It is shown how the curve for the second derivative may be obtained using an oscilloscope. (T.R.H.)

11893 AEC-tr-2559
OSCILLATIONS IN A DISCHARGE AS A SOURCE OF MOVING STRIATIONS. A. A. Zaitsev. Translated from Doklady Akad. Nauk S.S.S.R. 79, 779-81(1951). 5p.

Moving striations are a common phenomenon during gas discharges and are observed in molecular gases as well as in inert gases. They result from oscillatory processes in the discharge. Perturbations of the positive column, caused by sources probably in the anode region, are propagated through the column in the form of longitudinal electric waves (moving striations). (T.R.H.)

11894 AEC-tr-2560
CONDITIONS FOR NATURAL OSCILLATIONS AND MOVING STRIATIONS IN A GAS DISCHARGE. A. A. Zaitsev. Translated from Doklady Akad. Nauk S.S.S.R. 84, 41-4(1952). 5p.

Experiments are discussed which attempt to establish the conditions for occurrence of auto-oscillation and moving striations in gas discharges. (T.R.H.)

11895 AEC-tr-2563
INVESTIGATION OF THE WIDTH OF SPECTRAL LINES IN AN ARC SOURCE OF LIGHT. A. Ya. Vyatskii (Vyatsky) and I. M. Nagibina. Translated from Doklady Akad. Nauk S.S.S.R. 98, 59-62(1954). 5p.

The results reported indicate a linear dependence of spectral line widths on the concentration of impurity atoms in the arc plasma. The spreading begins at concentrations corresponding to the point at which the gradation graph "bends over." (T.R.H.)

11896 AEC-tr-2568
ULTRA-HIGH-SPEED LIGHT PROCESSES. E. K.

Zavoĭskiĭ (Zavoisky) and S. D. Fanchenko. Translated from Doklady Akad. Nauk S.S.S.R. 100, 661-3(1955). 3p.

Transient electric sparks are studied by means of the image deflection method applied to an electron-optical image-converter. (T.R.H.)

11897 AEC-tr-2569

THE NATURE OF GLOBULAR LIGHTNING. P. L. Kapitsa. Translated from Doklady Akad. Nauk S.S.S.R. 101, 245-9(1955). 5p.

It is hypothesized that the phenomenon of globular lightning is a plasma absorbing intense radiowaves. (T.R.H.)

11898 AEC-tr-2571

ON THE RELATIVISTIC OSCILLATIONS OF A PLASMA. A. Akhiezer and R. Polovin. Translated from Doklady Akad. Nauk S.S.S.R. 102, 919-20(1955). 3p.

This paper was title-listed in Nuclear Science Abstracts as NSA 9-6695. (T.R.H.)

11899 AEC-tr-2573

LINE SHAPE AND LINE SHIFT FOR IONS IN THE POSITIVE BEAM OF GAS DISCHARGE. S. E. Frish and Yu. M. Kagan. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 12, 358-61(1948). 6p.

It has been shown that the character of motion of positive ions in the plasma of gas discharge can be judged by the displacement and shape of the spectral lines of the ions. The directed velocity of positive argon ions is calculated by means of the line shift, and values of the order of 1×10^4 to 2.3×10^4 cm/sec, depending on discharge current density and gas pressure in the tube were found. The results are extended to Kr and Xe. (T.R.H.)

11900 AEC-tr-2575

INVESTIGATION OF "EXCITATION TEMPERATURE" AND GAS TEMPERATURE AS A FUNCTION OF PRESSURE IN AN INTERMEDIATE GLOW-ARC DISCHARGE. V. P. Sychev. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 12, 382-5(1948). 4p.

The results of a study on the transition from a glow to arc in an electric discharge are presented to indicate the pressure limits corresponding to thermodynamic equilibrium. (T.R.H.)

11901 AEC-tr-2585

SPECTROSCOPY OF THE GAS DISCHARGE. S. E. Frish and Yu. M. Kagan. Translated from Vestnik Leningrad Univ., No. 1, 12-40(1948). 23p.

The extent of gas discharge theory and experimentation is briefly summarized. This summary is followed by an account of laboratory work on stepwise excitation, spectroscopic radiations of ions in a plasma, cascade transitions, and collisions of the second kind. (D.E.B.)

11902 AEC-tr-2586

MOVING LAYERS IN STATIONARY GLOW DISCHARGE. A. A. Zaitsev and L. Pekarek. Translated from Vestnik Moskov. Univ. Ser. Fiz. Mat. i Estestven. Nauk, No. 3, 69-72(1954). 5p.

Data from the described experiment lead to the conclusion that the moving layers play the role of a feed-back link for self-excitation of the oscillations connected with them. (D.E.B.)

11903 AEC-tr-2587

THE INVESTIGATION OF VIBRATIONAL PROCESSES IN GLOW DISCHARGE FOR TRANSIENT CONDITIONS. L. Pekarek. Translated from Vestnik Moskov. Univ. Ser. Fiz. Mat. i Estestven. Nauk, No. 3, 73-6(1954). 5p.

An attempt at clarification of the method of self-excitation of current and voltage oscillations in inert gas discharges and clarification of the phenomenon of traveling layers is made, for the first time, for transient conditions. The experimental work on transient processes in the glow discharge of Ne is described. (T.R.H.)

11904 AEC-tr-2589

CONCERNING THE COMPOSITION OF LONGITUDINAL PLASMA OSCILLATIONS. A. A. Luchina and G. Ia. Myakishev (Miakishev). Translated from Vestnik Moskov. Univ. Ser. Fiz. Mat. i Estestven Nauk, No. 12, 57-61(1954). 5p.

It is shown that the principle of superposition can be applied to the interpretation of experimental data on plasma oscillations. (T.R.H.)

11905 AEC-tr-2593

MAGNETO-HYDRODYNAMIC WAVES IN GASES. V. L. Ginzburg (Ginsburg). Translated from Zhur. Eksptl'. i Teoret. Fiz. 21, 788-94(1951). 9p.

The nature of magneto-hydrodynamic waves in gases is treated on the basis of a microscopic theory. A hydrodynamical approximation to the solution of the problem is made. (T.R.H.)

11906 AEC-tr-2595

EXCITATION OF IONS IN A LOW-PRESSURE MERCURY DISCHARGE. Yu. M. Kagan and V. M. Zakharova. Translated from Zhur. Eksptl'. i Teoret. Fiz. 22, 400-5 (1952). 6p.

The paper studies the excitation of ions and atoms of Hg in a positive discharge column at low pressure. Spectroscopic observations confirm the postulate concerning the Maxwell velocity distribution of fast moving electrons. The excitation of ions occurs as a result of the direct collision of an atom with an electron. Tests associated with the displacement of spectral lines lead to the conclusion that ions fall practically freely upon the walls of the tube from the place where they are created. (auth)

11907 AEC-tr-2601

THE EFFECT OF THE EARTH'S MAGNETIC FIELD UPON THE INTERACTION OF RADIOWAVES IN THE IONOSPHERE. I. M. Vilenskiĭ (Vilensky). Translated from Zhur. Eksptl'. i Teoret. Fiz. 26, 42-56(1954). 18p.

A mathematical analysis of the interaction of radiowaves in the ionosphere is made and the effect of the earth's magnetic field is taken into account. (auth)

11908 AEC-tr-2605

INVESTIGATION OF THE SPEED OF DEVELOPMENT OF THE LEADER OF A LONG SPARK. I. S. Stekolnikov and M. A. Bagirov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 189-94(1954). 6p.

A study is made of the dependence of the speed of the leader of a long spark (50 to 400 cm) on the size of the braking resistance (R_T = 0.74 to 100 kΩ) in the spark circuit, the length of the discharge gap, and the degree of overvoltage (in the range k = 1-2). (auth)

11909 AEC-tr-2618

DETERMINATION OF THE ABSOLUTE CONCENTRATIONS OF ATOMS IN A MULTI-COMPONENT ARC-VAPOR. V. S. Melchenko. Translated from Zhur. Eksptl'. i Teoret. Fiz. 28, 628-9(1955). 5p.

It is shown that the Prilezhaeva method for determination of absolute concentrations of atoms in arc-vapors may be applied to multi-component arc-vapors. (T.R.H.)

11910 AEC-tr-2619

ON THE THEORY OF LANGMUIR PROBES. Iu. M. Kagan and V. I. Perel. Translated from Zhur. Eksptl'. i Teoret. Fiz. 29, 262-3(1955). 4p.

Langmuir's theory is compared with the exact theory of spherical probes for low pressures and for negative probe potential. (T.R.H.)

11911 AEC-tr-2621

INFLUENCE OF THE ELECTRIC CIRCUIT ON OSCILLA-

TIONS IN THE ARC DISCHARGE AT LOW PRESSURE. T. A. Suetin. Translated from Zhur. Tekh. Fiz. 17, 809-18(1947). 9p.

11912 AEC-tr-2627

ON THE HYDRODYNAMICS OF ELECTRIC DISCHARGES. G. A. Ostroumov. Translated from Zhur. Tekh. Fiz. 24, 1915-19(1954). 6p.

Electrical discharges, heretofore treated mostly from an electronic point of view wherein the medium in which the discharge occurs is regarded as an immovable rigid body, are treated from a hydrodynamic viewpoint. An attempt at establishing the basic physical laws of discharges in movable media and expressing the laws mathematically is made. (T.R.H.)

11913 AERE-Lib/Trans-688

MEASUREMENT OF PLASMA PARAMETERS BY THE PULSE METHOD IN A HIGH CURRENT DISCHARGE. B. A. Mahyrin. Translated by R. D. Lowde from Zhur. Tekh. Fiz. 23, 1915-19(1953). 6p.

Consideration is given to the limit of application of the pulse method of probe measurement as the current density of the discharge is increased and the duration of the voltage pulse supplied to the probe reduced. As an example of measurements taken with discharge currents of the order of a hundred amperes, the electron density distribution over the transverse section of a discharge tube is reproduced. (auth)

11914 AERE-Lib/Trans-759

PENETRATION OF CHARGED PARTICLES THROUGH AN ELECTRON PLASMA. A. I. Akhiezer and A. G. Sitenko. Translated by R. C. Murray from Zhur. Eksptl'. i Teoret. Fiz. 23, 161-8(1952). 10p.

The kinetic theory of the interaction of moving charged particles with an electron plasma is examined. This study indicates interaction at all particle velocities; contrary to the hydrodynamic prediction of interaction only when the particle velocities exceed the thermal velocity of the electrons in the plasma. (D.E.B.)

11915

HELMHOLTZ INSTABILITY OF A PLASMA. Theodore G. Northop (Univ. of California Radiation Lab., Livermore). Phys. Rev. 103, 1150-4(1956) Sept. 1.

A plasma having infinite electrical conductivity and no viscosity is assumed to be in contact with a uniform magnetic field along a plane boundary which is parallel to the field. The behavior of small perturbations of this boundary when the plasma is flowing at velocity v_0 perpendicular to the magnetic field is calculated by linearized theory. Perturbations which only move lines of force parallel to themselves are unstable; for small v_0/c the motion is incompressible and the rate of growth of the perturbation can be obtained from the incompressible hydrodynamic expression by replacing the mass density of each fluid in the hydrodynamic case by the sum of twice the magnetic energy density divided by c^2 and the mass density of each magnetohydrodynamic fluid. The magnetic field is to be considered as a "fluid" having only magnetic mass. It is shown that this analogy holds even in the nonlinear equations for two-dimensional incompressible flow. Perturbations which only bend lines of force are stable, while those which both move lines parallel to themselves and bend them are stable if the bending wavelength is short enough. (auth)

11916

CONTROLLED FUSION RESEARCH—AN APPLICATION OF THE PHYSICS OF HIGH TEMPERATURE PLASMAS. Richard F. Post (Univ. of California Radiation Lab., Livermore). Revs. Mod. Phys. 28, 338-62(1956) July.

A review of previous work in controlled fusion is given. Topics such as controlled fusion reactors, competing processes in the reactors, possible means for magnetic confinement of the plasma phenomena in a completely ionized gas, scaling laws, and plasma diagnostics are included. (J.H.M.)

ELECTRONS

11917 AEC-tr-2570

THE NATURAL WIDTH OF SPECTRAL LINES OF RECOIL ELECTRONS. B. Dzhelepov. Translated from Doklady Akad. Nauk S.S.S.R. 101, 825-8(1955). 5p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-5432. (T.R.H.)

11918 AEC-tr-2597

THE ELECTRON IN A WEAK PERIODIC ELECTRIC AND A HOMOGENEOUS MAGNETIC FIELD. A. E. Zilberman. Translated from Zhur. Eksptl'. i Teoret. Fiz. 23, 49-54 (1952). 8p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-2344. (T.R.H.)

11919

ELECTRON INTERFERENCE EXPERIMENTS. J. Arol Simpson (National Bureau of Standards, Washington, D. C.). Revs. Mod. Phys. 28, 254-60(1956) July.

Diffraction experiments emphasizing the electron rather than the diffractor are reviewed. Discussions of crystalline diffraction experiments, Fresnel diffraction, interference by amplitude division, and interferometer are included. (J.H.M.)

11920

THEORY OF ELECTRON INTERFERENCE EXPERIMENTS. D. Gabor (Imperial Coll. of Sci. and Tech., London). Revs. Mod. Phys. 28, 260-76(1956) July.

A general theory of electron interference experiments for application to the further development and utilization of interferometers is given. Special emphasis is placed on the conditions in which interferences can be observed. (J.H.M.)

11921

ELECTRON POLARIZATION, THEORY AND EXPERIMENT. H. A. Tolhoek (The University, Leiden, Netherlands). Revs. Mod. Phys. 28, 277-98(1956) July.

A formal description of electron polarization, the different ways of producing and detecting electron polarization, and experiments with polarized electrons are discussed. (J.H.M.)

11922

EXPERIMENTAL STUDIES OF POSITRON INTERACTIONS IN SOLIDS AND LIQUIDS. Stephan Berko and Frank L. Hereford (Univ. of Virginia, Charlottesville). Revs. Mod. Phys. 28, 299-307(1956) July.

A review of the phenomena of positron annihilation in solids and liquids is offered. Lifetime measurements, 2γ or 3γ annihilation rate detection, and 2γ angular correlation methods were used to study the interactions. (J.H.M.)

11923

THEORY OF POSITRON ANNIHILATION IN SOLIDS. Richard A. Ferrell (Univ. of Maryland, College Park). Revs. Mod. Phys. 28, 308-37(1956) July.

A theoretical discussion of positron annihilation in solids is offered. Topics such as positron annihilation in ionic crystals and metals, and positronium formation in insulators are included. (J.H.M.)

Refer also to abstracts 12080, 12081, and 12082.

GASES

11924 AEC-tr-2598

THE ELECTRICAL CONDUCTIVITY OF GASES AT HIGH TEMPERATURES AND DENSITIES. A. S. Karpenko, A. M. Markevich, and Yu. N. Ryabinin. Translated from Zhur. Eksptl'. i Teoret. Fiz. 23, 468-76(1952). 9p.

The electrical conductivity of air, A, N_2 and mixtures of the three at temperatures up to 8000°K and pressures of the order of 10^3 kg/cm^2 is described. The conductivity is attributed to the formation of NO at the high temperatures and pressures, since its ionization potential is lowest and N_2 and O_2 were present in the gases used. (T.R.H.)

11925 AEC-tr-2603

INSTABILITY OF TANGENTIAL DISCONTINUITIES IN A COMPRESSIBLE MEDIUM. S. I. Syrovatskii. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 121-3(1954). 4p.

The stability of a tangential discontinuity in a compressible medium for arbitrary infinitesimally small perturbations of its surface is treated mathematically. (T.R.H.)

11926 AEC-tr-2607

HEAT CAPACITY OF A GAS AT HIGH TEMPERATURES. B. L. Timan. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 262-4(1954). 4p.

A discussion of the effect of thermal ionization on the heat capacity of a gas at high temperatures is presented. (T.R.H.)

11927

THERMAL DIFFUSION IN KRYPTON AND ARGON. J. W. Corbett and W. W. Watson (Yale Univ., New Haven, Conn.). J. Chem. Phys. 25, 385-8(1956) Sept.

The mathematical description of a two-bulb thermal diffusion experiment is extended to the case of multicomponents isotopic mixtures. A self-consistent method of comparing two-bulb data to theoretical predictions is developed and applied to the argon data. The best fit for the modified Buckingham exp-six, $\alpha = 14$, intermolecular potential model is obtained for a force constant, $\epsilon/k = 110$°K. Measurements of the thermal diffusion factor of krypton versus temperature are presented and compared to the Lennard-Jones (9,5) and (13,7) and the modified Buckingham exp-six, $\alpha = 14$ models, yielding the force constant values, $\epsilon/k =$ 169, 395, and 470°K, respectively. (auth)

11928

SELF-DIFFUSION IN LIQUID ARGON. J. W. Corbett and J. H. Wang (Yale Univ., New Haven, Conn.). J. Chem. Phys. 25, 422-5(1956) Sept.

The self-diffusion coefficient of liquid argon was measured by the capillary technique. The average value of D at 84.31 ± 0.13°K and 658 ± 12 mm of Hg is $(2.07 \pm 0.06) \times 10^{-5}$ cm^2/sec. (auth)

11929

ENERGY REQUIRED TO PRODUCE ONE ION PAIR IN SEVERAL NOBLE GASES. Jerome Weiss and William Bernstein (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1253(1956) Sept. 1.

The absolute values of W, the energy to produce one ion pair, for electrons have been determined for purified noble gases. A parallel plate extrapolation ionization chamber, which could be evacuated, was used. The gases investigated were H_2, He, Ne, A, Kr, and Xe; and the absolute values of W were 36.3; 40.3; 35.3; 25.8; 24.7; 22.0 ev respectively based on W for air being 33.9 ev. (auth)

11930

DENSITY EFFECT ON THE IONIZATION IN GASES BY ELECTRONS. W.C. Barber (Stanford Univ., Calif.). Phys. Rev. 103, 1281-4(1956) Sept. 1.

The density effect on the ionization produced by electrons has been observed by comparing their specific ionization in He and H_2 gases at one and ten atmospheres pressure. The measurements were made by sending primary electrons of energy variable from 2 to 35 Mev through an ionization chamber into a Faraday cup. No density effect is observed or expected at one atmosphere pressure at these energies, but at ten atmospheres pressure, the results indicate the onset of the density effect at about 10 Mev in H_2 and 20 Mev in He. At 35 Mev, the percentage reduction in ionization from that expected without density effect amounts to (8.0 ± 1) in H_2 and (3.5 ± 1.3) in He. These results are in near agreement with the calculations of Sternheimer. (auth)

11931

FLOW OF GASES THROUGH POROUS MEDIA. P. C. Carman. New York, Academic Press Inc., 1956. 182p. London, Butterworths Scientific Publications.

The study of the permeability of porous media to gases includes viscous flow, unconsolidated beds and abnormal pore textures, slip, free molecule, and diffusional flow, permeability method of surface area measurement, flow of sorbable gases, separation of gas mixtures, transition to turbulent flow, flow through paper and textiles, and applications to fluidization. (J.E.D.)

11932

GAS PERMEATION THROUGH MEMBRANES DUE TO SIMULTANEOUS DIFFUSION AND CONVECTION. H. L. Frisch (Univ. of Southern California, Los Angeles). J. Phys. Chem. 60, 1177-81(1956) Sept.

The theory of gas permeation by simultaneous diffusion and convection through membranes possessing pores or channels is developed particularly in reference to gas transmission measurements through polymer films. Considerable simplification is obtained when the gas dissolved in the membrane matrix is in equilibrium across an interface with the gas in the channels (solution equilibrium). This state is generally attained rapidly. Measurements of the rate of gas transmission, particularly the time lag, under various applied pressure gradients can be shown to yield, besides the value of the diffusion constant, the gas solubility, the specific convection velocity of the gas as well as other parameters, characteristic of the permeation mechanism, information concerning the membrane porosity (and thus something of the structure). The effect of the absence of solution equilibrium is investigated and the magnitude of such an effect is estimated. The temperature dependence of the convective contribution to the permeability coefficient is derived. (auth)

11933

THE VISCOSITY OF MIXTURES OF GASES AT HIGH TEMPERATURES. M. J. Kenney, R. J. Sarjant, and M. W. Thring (Univ. of Sheffield, England). Brit. J. Appl. Phys. 7, 324-9(1956) Sept.

An accurate knowledge of the high temperature viscosity of mixtures of gases, such as the products of fuel combustion, is desirable for heat transfer calculations. The viscosities of mixtures of carbon dioxide and nitrogen were determined up to 900°C by a method in which the rate of fall of gas pressure in a closed, heated container is observed over a short period during which the gas is flowing out to the atmosphere along a heated capillary tube. A comparison is made between the experimental values obtained and those calculated for similar gas mixtures on the basis of a modern theory of transport coefficients. This comparison shows that it is possible to calculate the viscosities of gas mixtures at high temperatures with an accuracy of at least 2%. (auth)

11934

PERMEATION OF GASES THROUGH NICKEL DEPOSITS. I. DETERMINATION OF THE INTRINSIC PERMEABIL-

ITY OF NICKEL DEPOSITS TO GASES. D. T. Ewing and J. Martin Tobin (Michigan State Coll., East Lansing) and D. Gardner Foulke (Hanson-VanWinkel-Munning Co., Matawan, N. J.). J. Electrochem. Soc. 103, 545-8(1956) Oct.

Values have been obtained for permeability constants of Ni electrodeposits to H and He with a good degree of reproducibility, the values for 0.0001-in. deposits being of the order of 9 and 6×10^{-8}, respectively. Electrodeposited Ni has a porosity, in contrast to rolled Ni for which no permeability could be measured. Data show that the pores present in sound Ni electrodeposits are extremely small and that flow occurs by molecular streaming, probably at grain boundaries. (auth)

Refer also to abstract 11974.

INSTRUMENTS

11935 NRL-4702
Naval Research Lab., Washington, D. C.
ANALOGUE COMPUTATION OF QUOTIENTS AND FUNCTIONS CONTAINING QUOTIENTS USING MAGNETIC CORES. D. H. Schaefer. Jan. 23, 1956. 12p. Project Nos. HS-678-054 and NE-130-711-6A.

The fact that a magnetic core requires a given number of volt seconds to be driven from saturation in one direction to saturation in the other direction has been utilized to build a dividing circuit. This circuit, employing switching transistors and a single high remanance magnetic core, provides an output voltage whose average value is the quotient, with the correct sign, of two input voltages. A preliminary model of the divider gives accuracies of ±2.5% of full-scale readings for a quotient range of one hundred to one and input variation of both numerator and denominator of better than ten to one. By varying the waveforms of the inputs, a much more general computing element whose output is proportional to various functions containing quotients can be obtained. (auth)

11936 AEC-tr-2584
AN ELECTROLUMINESCENT AMPLIFIER OF LIGHT. Translated from Uspekhi Fiz. Nauk 54, 358-60(1954). 3p.

An apparatus is described which makes use of the phenomenon that some substances glow in a varying electric field. No applicability is described. (T.R.H.)

11937 AEC-tr-2626
INVESTIGATION OF THE GAS-ABSORBING POWER OF UNDISPERSED GETTERS. E. Lyubovskaya and A. Ravdel. Translated from Zhur. Tekh. Fiz. 24, 1392-1400(1954). 8p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-6974. (T.R.H.)

11938
THE RESOLVER, A CIRCUIT FOR REDUCING THE COUNTING LOSSES OF A SCALER. R. E. Bell (McGill Univ., Montreal, Canada). Can. J. Phys. 34, 563-76(1956) June.

The resolver is a circuit that reduces the counting losses of an ordinary scaler by storing up most of the pulses that otherwise would be lost in dead time, and releasing them uniformly at a safe rate for the scaler. Even for very short input pulses, the circuit contains no active elements that need to be fast enough to follow these pulses, and is thus simpler than an equivalent fast scaler. In a typical case the maximum permissible counting rate of the scaler is raised by a factor of the order of 30. The counting losses of such a circuit are computed. A detailed circuit and the results of tests on it are shown. (auth)

11939
DILATOMETER FOR STUDYING THE DENSIFICATION OF POWDER COMPACTS. I. G. Greenfield, R. L. Smith, and J. L. Rutherford. J. Franklin Inst. 261, 373-6(1956) Mar.

The dilatometer method and its instrumentation for the densification of powder compacts during sintering are presented. It was found that the advantages of this method are that it gives a continuous curve, is amenable to autographic recording, and shows the change in length of a powder compact during sintering. (J.E.D.)

11940
A.D.C. ARC CHAMBER FOR RADIOACTIVE MATERIALS. F. T. Birks and R. P. Thorne (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 33, 359-60(1956) Sept.

The design and operation of a d-c arc chamber for the analysis of radioactive materials are described. (W.L.H.)

ISOTOPES

11941 AECU-3345
Internuclear Co., Clayton, Mo.
ISOTOPE PRODUCTION IN A CORE OF MTR TYPE FUEL ELEMENTS. Glen E. Putnam. July 2, 1956. 21p. A-1 Project. (IC-GEP-56-12). $3.30(ph OTS); $2.40(mf OTS).

The nuclear properties of a reactor core of MTR type fuel elements are studied with regard to the feasibility of producing a gamma emitting isotope by means of thermal neutron absorption in a parent material in the reactor core. Specific consideration is given indium as the parent material, in which case the water in the core plays a triplicate role of moderator, coolant, and solvent for the indium sulfate. The reactor size, the critical mass, and the metal to water volume ratio in the core are the major independent variables. Characteristics such as Z (the parent isotope absorptions per U^{235} absorption), the core water volume, and certain criteria which impose limits on design are presented. It is the purpose of this memorandum to set forth the basic methods, constants, and assumptions employed in arriving at the reported results. (auth)

11942 AECU-3346
Internuclear Co., Clayton, Mo.
NUCLEAR CONSIDERATIONS ON BLANKET PRODUCTION OF ISOTOPES USING A CORE OF MTR FUEL ELEMENTS. Glen E. Putnam. July 2, 1956. 15p. A-1 Project. (IC-GEP-56-13). $3.30(ph OTS); $2.40(mf OTS).

The fast neutron leakage from a reactor core composed of MTR type fuel assemblies can comprise a very large fraction of the total neutron loss per fission. The characteristics of a system using the fast neutron leakage as a source of neutrons in a blanket are examined in this memorandum. Elementary methods are employed to evaluate the relationships of the major parameters such as reactor core size, metal volume to water volume ratio, and U^{235} content and to estimate the combined effects on the radial leakage of fast neutrons from cylindrical cores. (auth)

11943
PRODUCTION OF Be^7 IN THE ATMOSPHERE. A. J. Cruikshank, G. Cowper, and W. E. Grummitt (Atomic Energy of Canada Ltd., Chalk River, Ont. and Defence Research Chemical Labs., Ottawa). Can. J. Chem. 34, 214-19 (1956) Mar.

The concentration of Be^7 in the atmosphere has been determined by measuring the activity associated with dust particles in ground level air. It is calculated that the observed concentration is maintained by a production rate of 2300 atoms $Be^7/cm.^2/day$ in northern latitudes. (auth)

11944
ISOTOPE INDEX—THE COMPLETE PURCHASING GUIDE TO THE ISOTOPES. Indianapolis Scientific Equipment Corp., June 1956. 63p. $2.00.

Essential information on all available isotopes is collected. The index shows the potential user what materials are available and provides the supplier with a market. (F.S.)

MASS SPECTROGRAPHY

11945
THE MASS SPECTROMETRY OF THE ACTINIDE ELEMENTS. G. R. Hall and A. J. Walter (Atomic Energy Research Establishment, Harwell, Berks, England). Can. J. Chem. 34, 246-52(1956) Mar.

The problems involved in the mass spectrometry of the actinide elements and, in particular, the advantages of using a thermal ionization filament source are discussed. The relative behavior of each of the actinide elements from thorium to americium using this source is described and the results are considered with reference to the Saha equation. (auth)

MATHEMATICS

11946 AD-76222
Wayne Univ., Detroit and Stanford Univ., Calif.
SIMPLE ESTIMATORS OF THE PARAMETERS OF EXPONENTIAL DISTRIBUTIONS WHEN SAMPLES ARE CENSORED. Technical Report No. 4. Benjamin Epstein. Sept. 30, 1955. 18p. Contract DA-20-018-ORD-13272.

11947 ORNL-2134
Oak Ridge National Lab., Tenn.
MATHEMATICS PANEL SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1956. A. S. Householder, ed. Oct. 3, 1956. 28p. Contract W-7405-eng-26. $0.25(OTS).

The matrix norms are used effectively for the study of computational stability in the solution of differential equations. Partial differential equations in a rectangular region with constant coefficients are considered. A special genetics study using the progeny from two groups of male mice, one x irradiated with 600 r and one control, was made. A procedure that triangularizes the matrix by applying successive plane rotations is used for inverting a matrix and for solving the associated simultaneous linear equations. The effect of neutron irradiation on longevity in mice was shown by taking a sample of mice from male parents exposed to neutrons from a nuclear detonation. The multiple-cause-of-death problem is illustrated by an experiment where a group of mice, containing equal numbers of both sexes, is exposed to a sublethal dose of x radiation. An extensive compilation of cylinder-activation and solid-angle data was prepared. (For preceding period see ORNL-2037.) (J.H.M.)

11948 WADC-TR-56-20
Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.
AN ELEMENTARY APPROACH TO THE ANALYSIS OF VARIANCE. Paul R. Rider, H. Leon Harter, and Mary D. Lum. Feb. 1956. 69p. Project 7060. (AD-93394).

An introduction to the analysis of variance is given. Several important experimental designs to which this statistical technique is applicable are discussed, as are multiple comparison tests which can be used after the analysis of variance has been made. Transformations employed prior to analysis are also treated. An extensive bibliography is to be found at the end of the report. (auth)

11949
A 2^4 FACTORIAL EXPERIMENT IN FOUR BLOCKS OF EIGHT: A STUDY OF RADIOACTIVE DECONTAMINATION. Martin K. Barnett and Frank C. Mead, Jr. (Monsanto Chemical Co., Miamisburg, Ohio). Appl. Statistics 5, 122-31(1956).

The exploration of complex practical situations is facilitated by the prosecution of carefully designed factorial experiments. Such experiments provide conclusions of maximum generality and reliability at minimum expense. This is illustrated by a study of the effect of variations in four operating factors on the efficiency of a decontamination process for removal of radioactivity from liquid wastes, and it is shown how statistically significant interactions were explained by reasonable physico-chemical mechanisms. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

11950 ANL-5608
Argonne National Lab., Lemont, Ill.
ABSOLUTE BETA ASSAY WITH END-WINDOW GEIGER-MUELLER COUNTERS. George W. Reed, Jr. Aug. 16, 1956. 16p. Contract W-31-109-eng-38. $0.20(OTS).

Experimentally determined curves, which can be used to convert the activity of heavy samples (5 to 40 mg/cm^2), mounted on Al cards and covered with a thin plastic film, to that of weightless samples on essentially zero mass backing, are presented. Some preliminary data are presented which show the effect of sample thickness on the activity of thin samples (1 to 5 mg/cm^2) on zero mass backing. Half-thicknesses, which can be used to correct weightless sample activities for absorption by absorbers, air and counter window, are listed. Most of the nuclides studied are beta emitters having energies of 1 Mev or greater. (auth)

11951 KAPL-1571
Knolls Atomic Power Lab., Schenectady, N. Y.
BETA ENERGY DEPENDENCE CORRECTION FACTORS FOR CUTIE PIE AND JUNO SURVEY METERS. C. M. Hastings, C. G. Detwiler, and J. J. Fitzgerald. Apr. 27, 1956. 32p. Contract W-31-109-Eng-52. $0.25(OTS).

To determine the energy dependence of the Cutie Pie and Juno radiation survey meters, beta sources were evaluated for surface dose-rate by means of an extrapolation chamber. The energy dependence correction factors varied from 1.8 to 1.0 for the Cutie Pie and from 2.2 to 1.0 for the Juno in the energy range of 0.067 to 2.3 Mev (max). In addition, the study provided a basis for standardization of the window material to be used in these survey instruments. Mylar, 7 mg/cm^2 thick, which corresponds to the epidermis of the human skin, was chosen for the window material. (auth)

11952 NP-6094
Canada. Dept. of Mines and Technical Surveys, Mines Branch.
A SCINTILLATION PROBE FOR UNDERWATER USE. G. G. Eichholz and A. H. Bettens. Aug. 14, 1956. 12p. (TR-133/56).

A scintillation probe was designed to locate the presence of radioactive mill-tailings under water at depths up to 100 feet. The main features of the system and some operational experiences are described. (auth)

11953
SCINTILLATION COUNTER FOR BETA-RAY DOSIMETRY. Paul N. Goodwin (U. S. Public Health Service Hospital, Baltimore). Nucleonics 14, No. 9, 120-3(1956) Sept.

A new, simple, counter is described which should find applications in β-ray dosimetry in biology. Its major distinction is the use of tissue-equivalent materials for the detector and surroundings. Its operation and performance are discussed. (T.R.H.)

11954
DETECTION OF S^{35} AND Ca^{45} WITH A PLASTIC SCINTIL-

LATOR. Marvin L. Mitchell and Louis A. Sarkes (Lemuel Shattuck Hospital, Massachusetts Dept. of Public Health, and Boston Veterans Administration Hospital, Boston). Nucleonics 14, No. 9, 124(1956) Sept.

A plastic scintillator for detection of low energy β-rays such as from S^{35} and Ca^{45} is described which is twice as efficient as a G-M tube. The scintillator is insensitive to γ rays and registers a very low background which makes the use of Pb shielding unnecessary. (T.R.H.)

11955

HIGH-PRESSURE Al-WALLED SENSITIVE IONIZATION CHAMBER. P. A. Duffy (Westinghouse Electric Corp., Baltimore). Nucleonics 14, No. 9, 132-3(1956) Sept.

Successful dose-rate measurements in the range 1 to 50,000 mr/hr have been achieved with this rugged, durable, very stable chamber. Its high sensitivity comes from the use of argon at 17 atm pressure and the high specific ionization of the Al walls. Description, drawing, and photograph are included. (T.R.H.)

11956

RECENT DEVELOPMENTS IN LOW BACKGROUND GEIGER-MULLER COUNTERS. W. E. Grummitt, R. M. Brown, A. J. Cruikshank, and I. L. Fowler (Atomic Energy of Canada Ltd., Chalk River, Ont. and Defence Research Chemical Labs., Ottawa). Can. J. Chem. 34, 206-13(1956) Mar.

G-M counting assemblies have been constructed which give dependable low background operation in routine use. Possible construction materials have been examined in detail for radioactive content in an effort to achieve minimum inherent activity in the assembly. The cosmic ray component of the normal background has been eliminated by an anticoincidence arrangement. Increased reliability of the system is obtained through use of a multiple anode anticoincidence counter in place of a bundle of tubes, use of an electronic quench on both sample and shielding counters, and operation of the assembly as flow counters in tandem. In the best arrangement to date a copper counter with a polystyrene seal gives a background of 0.9 cpm. (auth)

11957

DISINTEGRATION-RATE DETERMINATION BY 4π-COUNTING. PART IV. SELF-ABSORPTION CORRECTION: GENERAL METHOD AND APPLICATION TO Ni^{63} β-RADIATION. B. D. Pate and L. Yaffe (McGill Univ., Montreal, Canada). Can. J. Chem. 34, 265-74(1956) Mar.

A method of preparing thin uniform sources of radioactive materials for use in a 4π counter is described. The radioactive nuclides are formed into organic compounds and are subsequently distilled on to thin VYNS films. Electron mircoscope photographs of the deposits are shown. The material is uniformly deposited in crystals of about 1 μ in diameter. The distillation can be rendered quantitative. The amount of material on the film can be estimated either spectrophotometrically in situ or by appropriate chemical means. Using this method a self-absorption curve for Ni^{63} (maximum beta energy 67 kev) is obtained. (auth)

11958

CELLOPHANE-DYE DOSIMETER FOR 10^5 TO 10^7 ROENTGEN RANGE. Ernest J. Henley and David Richman (Columbia Univ., New York). Anal. Chem. 28, 1580-2(1956) Oct.

A recording integrating chemical dosimeter, capable of measuring γ and β doses from 200,000 to 10,000,000 roentgens is described. Calibration curves are presented for 0.8-, 2-, and 3-Mev β radiation, and for a cobalt-60 γ source over a dose rate range of 10^5 to 10^7 roentgens per hour. The dosimeter is fabricated from commercially available cellophane, and is convenient, inexpensive, and stable. (auth)

11959

DESIGN ASPECTS OF RADIATION INSTRUMENTS. E. N. Shaw. Nuclear Eng. 1, 245-9(1956) Sept.

Radioisotopes are still only little used in production control processes. One of the major problems to be overcome in advising the production engineer on the potentialities and also the limitations of radiation instruments. Continuous and switch operation are discussed in terms of accuracy and speed of response. (auth)

11960

A SIMPLIFIED METHOD OF ESTIMATING INTEGRAL DOSE IN RADIOTHERAPEUTIC PRACTICE. R. Kenneth Loeffler (Temple Univ. Coll. of Medicine, Philadelphia). Radiology 67, 371-7(1956) Sept.

A series of curves is presented, one for each of several qualities of radiation, showing the dependence of integral dose of x radiation upon thickness of the absorbing body. By multiplying the air dose delivered to a field by the area of that field, and by the thickness factor obtained from the appropriate curve, an integral dose may be computed which will be reasonably correct if the absorbing material is of unit density. For heterogeneous media, the errors will be similar to those resulting from the use of standard isodose curves under the same circumstances. A technique is presented for estimating integral dose which is sufficiently simple that it may be used as a routine for every treatment plan. (C.H.)

Refer also to abstracts 11726 and 11920.

MESONS

11961 NP-5854

Cornell Univ., Ithaca, N. Y.

ELEMENTARY PARTICLES. PART I. LIGHT MESONS. H. A. Bethe. July 1955. 14p.

The properties of π and μ mesons are given, and the mechanism of π meson interaction with nucleons is discussed. (D.E.B.)

11962 NP-5855

Paris. Ecole Polytechnique. Laboratoire.

THE "STRANGE PARTICLES" HEAVY MESONS AND HYPERONS. Louis Leprince-Ringuet. [1955?]. 17p.

The properties and decay characteristics of heavy mesons and hyperons are given, discussed, and compared. (D.E.B.)

11963

PAIS-PICCIONI EXPERIMENT. K. M. Case (Univ. of Michigan, Ann Arbor). Phys. Rev. 103, 1449-53(1956) Sept. 1.

Two experiments to check the Gellmann-Pais "particle mixture" suggestion are analyzed, by using a detailed, if crude, phenomenological description. A cloud-chamber experiment of the type proposed by Pais and Piccioni is compared to an experiment using a liquid-xenon bubble chamber. It is found that for likely values of the parameters involved, both experiments are considerably more difficult than envisaged by Pais and Piccioni. For intensity reasons, the bubble-chamber experiment seems preferable. However, if accidentally the relevant cross sections have rather special values, experiments of this type would be particularly easy. (auth)

11964

CAPTURE OF K^- MESONS BY NUCLEI. D. M. Haskin, Theodore Bowen, and Marcel Schein (Univ. of Chicago). Phys. Rev. 103, 1512-18(1956) Sept. 1.

Seventy events of K^- capture at rest have been analyzed in emulsion stacks exposed to the Berkeley Bevatron. The

distribution of prong numbers and energy release of stars is given. The average prong number was 3.3 and the maximum prong number was 10. The small average energy release was found to be consistent with the assumption that in many events a large fraction of the K^- rest energy is carried away by neutral particles. The energy distribution of emitted nucleons was found to include energies up to 200 Mev. The energy distribution of emitted pions falls into two groups, one with a sharp upper limit corresponding to the expected pion energy of Σ-hyperon reactions and the other corresponding to Λ^0-hyperon reactions. The energy release in $\Sigma\pi$ events was found to be consistent with the assumption that the capture process takes place on bound nucleons. A small difference in the energy release of $\Sigma^+\pi^-$ events was found, indicating a possible mass difference $M(\Sigma^-) > M(\Sigma^+)$. An estimate of the ratio of production of Σ to Λ^0 hyperons, based on pion energies, gave Σ/Λ^0 about 2. The ratio Σ^-/Σ^+ was found to be $\geq 1/3$. The emission of pions with energies of more than 100 Mev was found, providing evidence for the direct production of Λ^0 hyperons. Hyperfragments were observed in four events. In one event two fast particles of nucleonic mass were emitted, one of them disappearing in flight, providing evidence for the existence of two-nucleon reactions. (auth)

11965

ALTERNATE MODES OF DECAY OF NEUTRAL K MESONS. S. B. Treiman and R. G. Sachs (Princeton Univ., N. J.). Phys. Rev. 103, 1545-9(1956) Sept. 1.

Consideration is given to the possibility that the θ^0 particle can decay via the "anomalous" modes $(e\pi\nu)$ and $(\mu\pi\nu)$. It is shown that, as a function of time, the decay rate for θ^0 disintegration into a final state of this type, having definite signs of the charges, is the sum of three terms. Two of these are the expected exponentially decaying functions, characterized by the rates λ_1 and λ_2 for decay of the particles denoted as θ_1 and θ_2 by Gell-Mann and Pais. The third term is the product of an exponential having the decay rate $(\lambda_1 + \lambda_2)/2$ and an oscillating factor whose frequency depends on the difference in mass between the θ_1 and θ_2 particles. It arises from interference between θ_1 and θ_2 decay and has opposite signs for the $(e^+\pi^-\nu)$ and $(e^-\pi^+\bar{\nu})$ modes. Similar effects occur for the muon decay modes. This interference may have the effect that the rate of disintegration into any one such final state increases with time during the early stages of decay. The detailed shape of the decay curve may be quite sensitive to the (θ_1,θ_2) mass difference. On the basis of presently available data on "anomalous θ^0" decay events, it is estimated that $1/\lambda_2 > 5 \times 10^{-9}$ sec. (auth)

11966

DIAGRAMS FOR PROCESSES INVOLVING HYPERONS. J. Tiomno (Centro Brasileiro de Pesquisas Fisicas and Faculdade Nacional de Filosofia, Rio de Janeiro, Brazil). Phys. Rev. 103, 1589-90(1956) Sept. 1.

MOLECULAR PROPERTIES

11967

THE LUMINESCENCE OF URANIUM-ACTIVATED SODIUM FLUORIDE. W. A. Runciman (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A237, 39-47(1956) Sept. 25.

The fluorescence and absorption spectra of various U-activated NaF phosphors have been studied at liquid-N_2 and liquid-He temperatures. These results are interpreted in terms of a model in which the U ion is surrounded octahedrally by six oxygen ions. Experiments with O^{18} have provided support for this atomic configuration, several lines in the fluorescence spectrum having an isotope shift. These isotope shifts are in agreement with the predictions of a general theory of the vibrational fine structure in luminescence spectra. (auth)

11968

IONIZATION ON PLATINUM AND TUNGSTEN SURFACES. II. THE POTASSIUM HALIDES. Sheldon Datz and Ellison H. Taylor (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 25, 395-7(1956) Sept.

The ionization of the potassium halides on W follows the Saha-Langmuir equation and indicates the formation of stable partial films of halide. On Pt, however, reflection occurs amounting to more than 99% for KCl, KBr, and KI, and about 75% for KF. (auth)

NEUTRONS

11969 AECU-3334

Internuclear Co., Clayton, Mo.

CALCULATION OF τ FOR DELAYED NEUTRONS. Kenneth A. Hub. May 15, 1956. 3p. A-1 Project. (IC-KAH-56-4). $1.80(ph OTS); $1.80(mf OTS).

A circulating fuel reactor introduces delayed neutrons into the primary loop because certain fission products are neutron emitters. These delayed neutrons, in the case of an aqueous homogeneous reactor, can cause a high neutron flux. For food irradiation these neutrons may limit the availability of fission product gamma if ϕt is limited. (auth)

11970 BNL-2585

Brookhaven National Lab., Upton, N. Y.

THERMAL NEUTRON MEASUREMENTS WITH STRAIGHT CYLINDRICAL AIR DUCTS IN WATER. F. J. Shore and R. D. Schamberger. [nd]. Decl. May 1, 1956. 56p.

Data from experimental measurements of thermal neutron transmission through air ducts in H_2O are given. A detailed discussion of the data appears in BNL-390. (D.E.B.)

11971

NEUTRON FLUX SPECTRA IN AIR. Samuel S. Holland, Jr. and Paul I. Richards (Technical Operations, Inc., Arlington, Mass.). J. Appl. Phys. 27, 1042-50(1956) Sept.

Application of the moment method is made to the penetration and slowing down of neutrons in infinite media. General considerations are restricted mainly to those modifications of the method necessary for the neutron problem; in particular, a special technique is given for reducing the integral term of the neutron transport equation. Calculations are carried out for point isotropic monoenergic neutron sources of 1, 100, 500 kev, 1, 2, 5, and 14 Mev in an infinite atmosphere of air. Best available numerical values of the cross sections are used, and the effects of absorption, anisotropic angular distributions, and inelastic scattering are included. Distances out to 10 mean free paths are considered. (auth)

11972

REACTOR PHYSICS. 5. James F. Hill (Reactor School, Harwell, Berks, England). Nuclear Power 1, 218-21(1956) Sept.

When neutrons are slowed down by elastic collisions it was shown that energy is lost in discrete amounts, but except where the moderator is composed of very light nuclei, the simplifying assumption that energy loss is continuous can be justified. An expression is derived for the time taken for a fission neutron to slow down to thermal energy. Cases are examined in detail of slowing down in infinite capturing and non-capturing media and expression for the resonance escape probability derived. The case of the finite non-capturing medium leads to the concept of the Fermi age of neutrons and to the derivation of the Fermi

age equation. Consideration of the idea of a slowing down length leads to an expression analogous to the diffusion length. (auth)

NUCLEAR PHYSICS

11973 ISC-652
Ames Lab., Ames, Iowa.
SECONDARY ELECTRON EMISSION DUE TO POSITIVE ION BOMBARDMENT. John W. Murdock and Glenn H. Miller. June 1955. 32p. Contract W-7405-eng-82. $0.25(OTS).

Stray electrons were produced in the Ames Laboratory linear accelerator by the ion beam striking the target and various other parts of the accelerator. This experiment was done to determine if the stray electrons from parts of the accelerator other than the target could be reduced by using construction materials other than brass. Measurements of the number of electrons produced from several materials, however, indicated that there is no particular advantage in using other materials in place of brass. The ratio of electrons produced per proton bombarding a Cu target varied from 1.15 to 1.57 with a high at 1.64 as the ion beam energy was varied from 23 to 130 kv. In this same beam energy, the range varied more for diatomic and triatomic H. The ratio for triatomic H increased from 1.48 to 3.59. Measurements showed that most of the electrons produced at the target had an energy less than thirty ev. The curves for the integral electron energy distribution were similar to the curves for diode vacuum tubes. The energy measurement methods were similar to those used to produce the space charge limited curve of a diode; thus, it was assumed that the electrons bombarded from the target produced a space charge at the target similar to the space charge formed at the cathode of a diode. (auth)

11974 ISC-655
Ames Lab., Ames, Iowa.
MEASUREMENT OF THE IONIZATION YIELD OF LOW ENERGY ATOMIC PARTICLES IN GASES. Ralph Lowry and Glenn H. Miller. June 1955. 72p. Contract W-7405-eng-82.

The ionization yields of protons in N_2 were measured as a preliminary test of the feasibility of the experimental method and to check the performance of the apparatus. More precise measurements were made of the ionization yield of protons in A. The results indicated that any deviation from a linear relation between ionization yield and energy was small for energies above 25 kev. The slope of a least squares plot of the data corresponded to 26.5 ev per ip. The straight line representing the least squares plot intercepted the energy axis at 1.4 kev indicating a slight ionization defect for protons in A. (auth)

11975
EFFECT OF AN ELECTRIC FIELD ON POSITRONIUM FORMATION IN GASES: EXPERIMENTAL. S. Marder (Columbia Univ., New York) and V. W. Hughes (Yale Univ., New Haven, Conn. and Columbia Univ., New York). Phys. Rev. 103, 1258-65(1956) Sept. 1.

The increase in positronium formation due to a static electric field has been measured in various gases including He, Ne, A, H_2, D_2, N_2, and several more complex molecular gases by a study of the energy spectrum of the annihilation γ radiation. For the rare gases the increase has a sigmoid dependence on the ratio of electric field to pressure. The fraction of the positrons that form positronium increases by a maximum factor of 1.5, 1.4, and 2.1 for He, Ne, and A, respectively. A similar increase was observed for H_2, D_2, and N_2. No effect of the electric field was found in the polyatomic gases CO_2, CH_4, C_2H_6, and CCl_2F_2, but a small anomalous decrease in positronium formation was seen in SF_6. Some data are given using a microwave field at 2460 Mc/sec. The detailed theory of the increase given provides a basis for obtaining from the observed data values of the elastic scattering cross section of positrons by the rare gas atoms, which are $0.023\pi a_0^2$, $0.12\pi a_0^2$, and $1.2\pi a_0^2 \pm 25\%$ for He, Ne, and A, respectively. Quantitative interpretation for the polyatomic gases is more difficult. At the high electric fields for which positronium formation has its maximum value, the fraction of positrons forming positronium is between 50% and 80% for the rare gases and for H_2 and N_2; the mode of decay of the remaining positrons is not understood. (auth)

11976
EFFECT OF AN ELECTRIC FIELD ON POSITRONIUM FORMATION IN GASES: THEORETICAL. Werner B. Teutsch (Univ. of Pennsylvania, Philadelphia and Yale Univ., New Haven, Conn.) and Vernon W. Hughes (Yale Univ., New Haven, Conn.). Phys. Rev. 103, 1266-81(1956) Sept. 1.

A theory is developed to explain the influence of an electric field on positronium formation in gases. The Boltzmann equation is used to describe the behavior of the positrons under the combined influence of the electric field and molecular collisions. A diffusion equation in velocity space is deduced wherein the annihilation of free positrons and the disappearance of positrons by positronium formation are absorption terms. From this equation the functional dependence of the increase in positronium formation on the experimental parameters is calculated. The result describes correctly the experimental observations and yields information on the pertinent atomic processes. In particular, the cross sections for the elastic scattering of positrons by helium, neon, and argon are found to be $0.023\pi a_0^2$, $0.12\pi a_0^2$, and $1.5\pi a_0^2$, respectively, to about $\pm 25\%$. These values are considerably smaller than the corresponding quantities for electrons, and are in agreement with simple theoretical estimates. (auth)

11977
INERTIAL PARAMETERS FOR COLLECTIVE NUCLEAR OSCILLATIONS. Steven A. Moszkowski (Univ. of California, Los Angeles). Phys. Rev. 103, 1328-42(1956) Sept. 1.

Inertial parameters for nuclear rotation and quadrupole shape oscillation are known to be several times as large as the values assuming irrotational flow. These parameters may be calculated by using a method due to Inglis and applied in recent work by Bohr and Mottelson. The nucleus is assumed to be mainly in the lowest possible intrinsic state, but slightly perturbed by the time-dependence of the nuclear shape. It is convenient to separate the nuclear Hamiltonian into interactions of the individual nucleons with an average potential of the anisotropic harmonic oscillator type and residual interactions independent of deformation. Then the intrinsic motions of the nucleons must satisfy, at least approximately, self-consistency conditions between the potential and nuclear density. The nucleons outside closed shells are seen to contribute about half of the nuclear deformation. The excess of the inertial parameters over the irrotational values is related directly to the spread in energy of admixed excited states of the intrinsic motion, an essential consequence of the approximately independent motions of the nucleons. The inertial parameters are determined mainly by excitation of nucleons outside closed shells and they are inversely proportional to the square of the average excitation energy within a major shell. In summary, the nuclear collective motion appears to resemble the shell model situation more than was thought previously, especially as regards the dominant

role of the nucleons outside filled shells. Empirical values of the inertial parameters are discussed in the light of these results, and a comparison is made with the recent analysis of Bohr and Mottelson. Anomalies in the empirical gyromagnetic ratios of rotational motion for odd-A nuclei result from the important role of the unpaired nucleon. With the aid of a simplified model in which the unfilled shell is assumed to be a p shell, it is possible to account qualitatively for a number of the observed features. (auth)

11978

ENERGIES OF π-MESONIC X-RAYS. Martin Stearns and Mary Beth Stearns (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 103, 1534-44(1956) Sept. 1.

The energies of the $2p \rightarrow 1s$ x rays from the π-mesonic atoms Li through F have been measured to ½% or better. All the measured energies were lower than those calculated from the Klein-Gordon equation assuming a point-charge Coulomb field and corrected for finite size effects and vacuum polarization. (These are the only non-negligible electromagnetic corrections.) This indicates that the net nuclear interaction between a meson in the 1s orbit and a nucleus is repulsive. The energy shifts varied in a fluctuating manner from 3.4% for Li to 11.7% for O and 11.4% for F. If it is assumed that the shift arises from a scattering type potential, and further, that the effects of the individual nucleons are simply additive, then values for the s-wave scattering lengths a_1 and a_3 can be obtained by a least squares fit to the data. The values of a_1 and a_3 obtained in this manner are $a_1 = 0.14_5\lambda\!\!\!^{-}_{\pi}$ and $a_3 = -0.10\lambda\!\!\!^{-}_{\pi}$. The K_α energies of the isotopes B^{10} and B^{11} were measured separately, thus giving a direct determination of a_3 under the previous assumptions. This value for a_3 is $(-0.12 \pm 0.02)\lambda\!\!\!^{-}_{\pi}$. The energies of $\pi - L_\alpha$ x rays for Si, Cl, K, and Ca were also measured but with less accuracy. They were all found to agree with the calculated energy values to within 1% or better. A rough measure of the width of the B^{10} K_α line was also obtained. (auth)

11979

THE NEUTRINO. Frederick Reines and Clyde L. Cowan, Jr. (Los Alamos Scientific Lab., N. Mex.). Nature 178, 446-9(1956) Sept. 1.

A theoretical study of the neutrino and its properties is offered. The identity or non-identity of the neutrino, ν^+, and the antineutrino, ν^-, is considered. Experimental evidence by a detector and the availability of neutrinos from reactors are discussed. (J.H.M.)

11980

NUCLEAR COOLING. N. Kurti, F. N. H. Robinson, Francis Simon, and D. A. Spohr (Clarendon Lab., Oxford, England). Nature 178, 450-3(1956) Sept. 1.

Previous experiments on nuclear cooling are reviewed. Also included are the steps involving nuclear cooling. It was shown that by using nuclear demagnetization one can reach temperatures below those accessible with electron paramagnetic substances. Direct evidence of the interactions between nuclei in metals is offered. (J.H.M.)

11981

RELATIVISTIC EFFECTS IN HEAVY NUCLEI. G. Marx (Institute for Theoretical Physics of the Roland Eötvös Univ., Budapest). Nuclear Phys. 1, 660-9(1956) Aug.

The binding energy of a model nucleus is discussed in a zero-range scalar field of nuclear forces keeping the relativistic effects in view. According to our results the scalar field free from exchange forces may account for the saturation of the binding energy, in contrast to the conclusions drawn from calculations based on a non-relativistic approach. From the point of view of quantum theory these considerations are of an approximate character; they may, however, serve as evidence for the decisive role which relativistic effects may play in the theory of heavy nuclei. (auth)

11982

ELECTRON SCATTERING AND NUCLEAR STRUCTURE. Robert Hofstadter (Stanford Univ., Calif.). Revs. Mod. Phys. 28, 214-54(1956) July.

Scattering theory is discussed, including scattering from point charges, scattering from nuclei of finite size, and phase shift analysis of electron scattering. Scattering phenomena such as nuclear recoil, inelastic scattering, magnetic scattering, and angular shapes of nuclei are discussed. Spectrometer installations for 190- and 550-Mev electrons are described. The behavior of Cherenkov detectors is briefly discussed. Results of electron scattering from protons, deuterons, α particles, Li^6, C^{12}, Mg^{24}, Si^{28}, S^{32}, A^{40}, Sr^{88}, Ca, V, Co, In, Sb, Hf, Ta, U, Au, Bi, Th, and U are included. The internal structure of the neutron as determined from the e-n reaction is discussed. The validity of electrodynamics is also discussed, and comparisons of the electron scattering method with other measurements of nuclear sizes are reviewed. (J.H.M.)

NUCLEAR PROPERTIES

11983 AECU-3330

Internuclear Co., Clayton, Mo.

MEV YIELD PER NEUTRON CAPTURED FOR ELEMENTS OF PROMISE FOR A GAMMA REACTOR. Raphael J. Jaffe. June 4, 1956. 20p. A-1 Project. (IC-RJJ-56-2). $3.30(ph OTS); $2.40(mf OTS).

On the basis of Mev yield per neutron capture, nuclides most suitable for gamma source production by reactor irradiation were chosen. The decay schemes and gamma spectra are given for the 11 most promising nuclei. (D.E.B.)

11984 CRP-654

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A TABLE OF LEVY'S EMPIRICAL ATOMIC MASSES. James Riddell. July 1956. 90p. (AECL-339).

Nearly 4,000 atomic masses have been calculated from Levy's empirical mass equation. These, together with the neutron, proton and alpha-particle binding energies which can be calculated from them, are tabulated. (auth)

11985

PILE NEUTRON CAPTURE CROSS SECTION OF 33 Hr. Ce^{143}. L. P. Roy and L. Yaffe (McGill Univ., Montreal, Canada). Can. J. Chem. 34, 238-45(1956) Mar.

Ce^{144} has been produced by the successive neutron capture reaction $Ce^{142}(n,\gamma)Ce^{143}(n,\gamma)Ce^{144}$. The pile neutron capture cross section of the 33-hr Ce^{143} was determined by separating Pr^{144}, the daughter of Ce^{144}, from the rigorously-purified cerium at frequent intervals. The amount of Pr^{144} formed increased linearly with the square of the neutron flux in a manner consistent with that of a successive neutron capture reaction. The value for the pile neutron capture cross section of Ce^{143} was found to be 6.0 ± 0.7 barns. (auth)

11986

THE PREPARATION AND PROPERTIES OF Pu^{242}. J. P. Butler, M. Lounsbury, and J. S. Merritt (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem. 34, 253-8 (1956) Mar.

Three samples of plutonium rich in Pu^{242} and containing from 1.7 to 8.6% Pu^{238} have been prepared by the neutron irradiation of Am^{241}. From mass analyses and measurements of the alpha abundance of Pu^{242}, the alpha half life of Pu^{242} was determined as $3.73 \pm .05 \times 10^5$ yr. The spontaneous fission half life of Pu^{242} was also measured as $6.6_4 \pm 0.10 \times 10^{10}$ yr. (auth)

11987

THE MASS ASSIGNMENT OF THE CHAIN 2 MIN. Sb → 77.7 Hr. Te → 2.25 Hr. I. W. H. Fleming and H. G. Thode (McMaster Univ., Hamilton, Ont., Canada). Can. J. Chem. 34, 408-9(1956) Mar.

In the determination of fission yields of Xe^{133}, fission product Xe was extracted from neutron irradiated U and Pu before all of the 77.7-hr. Te activity had decayed. By a comparison of the relative abundances of Xe^{132} and Xe^{134} in these samples, the effective half life of the precursors of Xe^{132} can be determined assuming that these are no long lived members in the 134 mass chain. (W.L.H.)

11988

NUCLEAR QUADRUPOLE RESONANCE SPECTRUM OF B^{11} IN KERNITE. R. R. Haering and G. M. Volkoff (Univ. of British Columbia, Vancouver). Can. J. Phys. 34, 577-85 (1956).

The pure quadrupole resonance frequencies of B^{11} nuclei at two different sites (denoted by E and F) in a single crystal of kernite ($Na_2B_4O_7.4H_2O$) have been determined both by observing the B^{11} resonances in zero external magnetic field, and also by investigating their Zeeman splitting in magnetic fields up to 30 gauss. The values obtained are 1281.1 ± 2 and 1287.0 ± 1 kc/sec for the E and F sites, respectively. These frequencies agree within experimental error with the values 1286 ± 4 and 1287 ± 3 kc/sec predicted on the basis of studies in a magnetic field of 7000 gauss. The agreement for the F site is much better than for the E site. These zero field resonances have also been observed in a polycrystalline sample. The observed weak field Zeeman splitting for the single crystal agrees very well with that calculated from high field data for F sites, but at present disagrees with the corresponding calculation for E sites. A Na^{23} pure quadrupole resonance in kernite has also been measured at 1560.0 ± 1 kc/sec. The second Na^{23} resonance expected from high field work has not been observed to date. (auth)

11989

IONIZATION ON PLATINUM AND TUNGSTEN SURFACES. I. THE ALKALI METALS. Sheldon Datz and Ellison H. Taylor (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 25, 389-94(1956) Sept.

The ionization of all of the alkali metals on W and on WO_3 surfaces follows the Saha-Langmuir equation with no reflection. On Pt, however, a departure from this equation indicates partial reflection of the atoms. The reflection of Na is probably 0%, since the ionization efficiency is given closely by the Saha-Langmuir equation with a value of 5.50 ev for the work function of Pt at 2000°K. The same value of the work function then indicates reflections of 18% for Li, 48% for K, 22% for Rb, and 8% for Cs, at 2000°K. (auth)

11990

DIMERIZATION OF SOLID GROUP IIIB TRIHALIDES. II. IODINE NUCLEAR QUADRUPOLE RESONANCE SPECTRA OF AlI_3, GaI_3, AND InI_3. S. L. Segel and R. G. Barnes (Univ. of Delaware, Newark). J. Chem. Phys. 25, 578-9 (1956) Sept.

The I^{127} nuclear quadrupole resonance spectra have been detected in AlI_3, GaI_3, and InI_3. The observed frequencies at 77°K and at 24°C are reported and discussed. (T.R.H.)

11991

NUCLEAR MAGNETIC RESONANCE ABSORPTION BY H_2O ON TiO_2. John M. Mays and George W. Brady (Bell Telephone Labs., Murray Hill, N. J.). J. Chem. Phys. 25, 583 (1956) Sept.

The results of these studies show that molecular motion occurs down to 77°K under low coverage conditions. When coverage is increased to the order of a monolayer, immobilization occurs at 77°K due to interaction of adsorbed molecules, and the resonance has a breadth appropriate to ice. It is indicated that NMR is a powerful tool for study of adsorbed layers in the low coverage ranges. (T.R.H.)

11992

RADIOCHEMICAL MEASUREMENTS OF THE NATURAL FISSION RATE OF URANIUM AND THE NATURAL OCCURRENCE OF THE SHORT-LIVED IODINE ISOTOPES. P. K. Kuroda, R. R. Edwards, and F. T. Ashizawa (Univ. of Arkansas, Fayetteville). J. Chem. Phys. 25, 603(1956) Sept.

Previous unsuccessful attempts to measure the activity of the short-lived iodine isotopes in U salts are described and are repeated and the results reported here. Taking the average fission yield for I^{131}, I^{133}, and I^{135} to be 3.0 ± 0.3% the spontaneous fission half life of U^{238} is calculated to be $(1.03 \pm 0.10) \times 10^{16}$ yr. (T.R.H.)

11993

MEASUREMENT OF SMALL NUCLEAR SPIN-SPIN COUPLING CONSTANTS. C. A. Reilly (Shell Development Co., Emeryville, Calif.). J. Chem. Phys. 25, 604-5(1956) Sept.

A method for the accurate measurement of nuclear spin-spin coupling constants smaller than a few cps is described. It is useful when the resolving power of the NMR spectrometer is limited by short-term instability of the applied magnetic field rather than by its inhomogeneity. (T.R.H.)

11994

ELECTRON CAPTURE OF Yb^{169} TO LEVELS IN Tm^{169}. J. W. Mihelich, T. J. Ward, and K. P. Jacob (Univ. of Notre Dame, Ind.). Phys. Rev. 103, 1285-92(1956) Sept. 1.

The decay of Yb^{169} by electron capture has been studied with permanent magnet spectrographs and scintillation counter techniques. Multipolarities of all transitions (including mixing) have been deduced. A level scheme is proposed. Two metastable levels of 4×10^{-7} and 4.5×10^{-8} second have been found, in addition to the well-known 6.4×10^{-7} sec level. These metastable levels are all depopulated by D + Q mixtures in which the dipole radiation is greatly retarded (by factors of 10^6 to 10^8) and the quadrupole radiation is retarded by factors of 10^2 to 10^3 as compared to the single-particle estimates. For certain transitions the corrections to the M1 internal conversion coefficients (necessary because of finite nuclear size) have been obtained for the K, L_I and L_{II} shells. The screening correction for the K–LL Auger lines has been obtained for this nucleus (Z = 69). (auth)

11995

HYPERFINE STRUCTURE AND NUCLEAR MOMENTS OF GADOLINIUM FROM PARAMAGNETIC RESONANCE SPECTRUM. W. Low (Univ. of Chicago). Phys. Rev. 103, 1309(1956) Sept. 1.

The hyperfine structure in the paramagnetic resonance spectrum of Gd^{3+} was resolved and a nuclear spin of $3/2$ was found for each of the two odd isotopes Gd^{155} and Gd^{157}. The ratio of the nuclear magnetic moments is $\mu_I(Gd^{155})/\mu_I(Gd^{157}) = 0.75 \pm 0.07$. The hyperfine structure in the $^2S_{7/2}$ state of Gd^{3+} arises probably from unpaired s-electron states which are admixed to the ground state by configurational interaction. Assuming the same degree of configurational interaction in Gd^{3+} as in isoelectronic Eu^{2+}, one finds the ratio $\mu_I(Eu^{151})/\mu_I(Gd^{157}) = 11.3$. If one takes $\mu_I(Eu^{151}) = 3.6$ nm, the values of the moments of Gd are $\mu_I(Gd^{157}) = 0.32$ and $\mu_I(Gd^{155}) = 0.24$ nm. The experiments were made on single crystals of $LaCl_3 \cdot 7D_2O$ and $Bi_2Mg_3(NO_3)_{12} \cdot 24H_2O$ using enriched isotopes. (auth)

11996

ENERGY LEVELS OF CALCIUM ISOTOPES. Ca^{40}(d,p) REACTION. C. M. Braams (Massachusetts Inst. of Tech.,

Cambridge). Phys. Rev. 103, 1310-13(1956) Sept. 1.

The $Ca^{40}(d,p)Ca^{41}$ reaction was investigated with the MIT-ONR electrostatic generator, a 180-degree magnetic spectrograph, and a magnetic broad-range spectrograph. Bombarding energies from 2.5 to 7.0 Mev were used; targets were made of natural calcium; and the reaction angle was 90 degrees. The Q value for the transition to the ground state of Ca^{41} is 6.140 ± 0.009 Mev. Twenty-five excited states of Ca^{41} were found in the region of excitation from 1.947 to 4.194 Mev. (auth)

11997

RATIOS OF TRANSITION PROBABILITIES BETWEEN ROTATIONAL STATES IN ODD-A NUCLEI. G. Goldring and George T. Paulissen (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 103, 1314-20(1956) Sept. 1.

A γ-coincidence method has been developed for measuring relative electric excitation cross sections of the first two excited levels in odd-A nuclei. This method has been applied to eight nuclei in the region $63 \leq Z \leq 75$. In general the results agree very well with the strong-coupling collective-model theory, indicating that in any one nucleus Q is constant to within about 20%. The deviations, though small, are outside the limits of experimental error for a number of nuclei. (auth)

11998

MEASUREMENT OF THE MASS OF He^5. D. S. Craig, W. G. Cross, and R. G. Jarvis (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 103, 1427-9(1956) Sept. 1.

A Q value of 15.15±0.04 Mev for the reaction $Li^6(t,\alpha)He^5$ has been obtained through a measurement of the energy of the alpha particles. The mass of He^5 is then 5.01390± 0.00004 amu or $He^5 \rightarrow He^4 + n + 0.97 \pm 0.04$ Mev. The width of the ground state is 0.7±0.2 Mev. (auth)

11999

FIRST EXCITED STATES OF HEAVY EVEN-EVEN NUCLEI. Jack M. Hollander (Univ. of California, Berkeley). Phys. Rev. 103, 1590-1(1956) Sept. 1.

Recent data on first excited states of heavy even-even nuclei are tabulated. (B.J.H.)

12000

NUCLEAR SPIN OF AMERICIUM-241. R. P. Thorne (Atomic Energy Research Establishment, Harwell, Berks, England). Nature 178, 484-5(1956) Sept. 1.

The americium was excited in a hollow cathode cooled with liquid nitrogen. The hyperfine separations show a marked divergence from the interval rule. Thus a relatively large quadrupole moment is expected for Am. It would appear that the nuclei of Am^{241} and Np^{237} have a ground state of $f\,^5/_2$. (J.H.M.)

12001

HIGH-ENERGY EXCITATION FUNCTIONS IN THE HEAVY REGION. W. W. Meinke, G. C. Wick, and G. T. Seaborg (Univ. of California, Berkeley). J. Inorg. and Nuclear Chem. 3, 69-92(1956) Sept.

The electrostatically deflected beam of the 184-inch cyclotron has been used with the stacked foil and absorber technique to determine the excitation functions for the following reactions: $Th^{232}(p,6n)Pa^{227}$, $Th^{232}(p,3n)Pa^{230}$, $Th^{232}(d,7n)Pa^{227}$, $Th^{232}(\alpha,p8n)Pa^{227}$, $Th^{232}(\alpha,p5n)Pa^{230}$, and $U^{238}(p,\alpha 8n)Pa^{227}$. The data are presented graphically and discussed individually for each of the reactions. Some rough excitation function data have also been determined for the reactions $Th^{232}(d,4n)Pa^{230}$, $U^{238}(p,\alpha 5n)Pa^{230}$, $Th^{232}(\alpha,7n)U^{229}$, and $Th^{232}(\alpha,6n)U^{230}$. The results are discussed in terms of compound nucleus formation, transparency effects, fission, and other factors in order to arrive at a qualitative picture for the mechanism of high-energy nuclear reactions with heavy nuclei. (auth)

12002

ZEEMAN SPLITTING OF NUCLEAR QUADRUPOLE RESONANCE LINE OF IODINE. Kineo Tsukada (Tokyo Univ. of Education). J. Phys. Soc. Japan 11, 956-63(1956) Sept.

Zeeman patterns of the nuclear Quadrupole resonance line of I^{127} were studied with a single crystal of I_2 at medium and weak magnetic fields. The asymmetry parameter of coupling, η, and the angle between bond axis of the I_2 molecule and crystallographic c axis, φ, were determined from the pattern at a medium magnetic field of about 120 gauss. The result was $\eta = -0.16 \pm 0.01$ at 14°C when crystallographic b axis was chosen as x axis and $\varphi = 31°38' \pm 60'$. The absolute value of η is in accord with the value obtained by the two resonance frequencies, i.e. 0.151 ± 0.001 at 11°C. φ agrees with that obtained by the x ray diffraction, 32°4'. At a weak magnetic field, Zeeman patterns of the fine structure of I_2 were examined at three directions of magnetic field against the I_2 crystal, i.e. the b axis, the c axis and the direction of 60° from the b axis in the bc plane. Behavior of the superregenerative detector used for these N.Q.R. measurements was studied and the observed shape of the resonance line is discussed. (auth)

12003

STRUCTURE OF NUCLEAR QUADRUPOLE RESONANCE LINE. I. SOLID IODINE. Shoji Kojima, Shizuko Ogawa, Shigeo Hagiwara, Yoshihito Abe, and Midori Minematsu (Tokyo Univ. of Education). J. Phys. Soc. Japan 11, 964-9 (1956) Sept.

The complex structure of the line which was found in the nuclear quadrupole resonance in solid I_2 was studied with recording instruments. The recorded pattern of the low-frequency line spread in the range of about 80 kc and resolved into five lines at least. The pattern changed considerably when the radiofrequency field was orientated with respect to the crystallographic axes. The structure was explained to be caused by the electron-coupled spin-spin interaction. (auth)

12004

THE ISOMER Pb^{204m}. C. J. Herrlander, R. Stockendal, J. A. McDonell, and I. Bergstrom (Nobel Inst. of Physics, Stockholm, Sweden). Nuclear Phys. 1, 643-56(1956) Aug.

The conversion lines following the decay of Pb^{204m} have been studied in a double-focusing β spectrometer and a semicircular permanent magnet β spectrometer. The half life of the isomer has been remeasured, and the value 67.5±0.5 min obtained. The energies of the previously known gamma transitions have been reinvestigated and are 911.7±0.3, 374.7±0.4, and 899.3±0.3 kev. The maximum amounts of M6 resp. M3 admixtures in the 911.7 kev E5 and 374.7 kev E2 transitions are found to be 0.5% in both cases. Two new weak gamma rays have been found with energies 289.4±0.2 and 622.2±0.2 kev, the latter being an E5 transition emitted from the isomeric 9— level to a new 4+ level. The experiments unambiguously suggest the following level sequence: 0 (0+), 899.3 (2+), 1274.0 (4+), 1563.4 (4+) and 2185.7 (9—) kev. The experimental level scheme is compared with the theoretical predictions by W. W. True. (auth)

12005

THE DISTRIBUTION OF ENERGY IMPARTED TO A HOMOGENEOUS MEDIUM NONUNIFORMLY IRRADIATED. G. Failla (Columbia Univ., New York). Radiation Research 5, 205-15(1956) Sept.

Refer also to abstract 12124.

NUCLEAR REACTORS

12006 AECU-3196

Atomic Power Development Associates, Inc., Detroit. SOME INHERENT AND DESIGN SAFETY FEATURES OF

THE APDA FAST BREEDER REACTOR. W. J. McCarthy, Jr. June 1956. 11p. $0.15(OTS).

12007 AECU-3321
Hanford Atomic Products Operation, Richland, Wash.
CLEANING AND TESTING OF GAS CIRCULATING PIPING. Acceptance Test Procedure 1292-KE. N. Yutani. June 30, 1953. 21p. Project CA-512-R. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

Acceptance test procedures for insuring that all piping, fittings and equipment of the gas system are correctly fabricated and installed and cleaned adequately prior to startup of Hanford Production Reactor (KE) are given. (T.R.H.)

12008 AECU-3322
Hanford Atomic Products Operation, Richland, Wash.
GAS SYSTEM — 105-KE INSTRUMENTATION. Acceptance Test Procedure 1299-KE. G. R. Wilde. July 23, 1954. 19p. Project CA-512-R. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The acceptance test procedures to be followed in demonstrating the operability of the gas systems of Hanford Production Reactor (KE) prior to startup are given. (T.R.H.)

12009 AECU-3323
Hanford Atomic Products Operation, Richland, Wash.
MOTOR CONTROL CENTERS AND STARTERS. Acceptance Test Procedure 1254-KE. L. F. Higginson. Aug. 4, 1953. 32p. Project CA-512-R. Contract [W-31-109-Eng-52]. $6.30(ph OTS); $3.00(mf OTS).

The acceptance test procedures for Hanford Production Reactor (KE) to be followed to assure that each motor control center is correctly wired and installed and that the control devices will function properly when the system is in operation are given. (T.R.H.)

12010 AECU-3324
Hanford Atomic Products Operation, Richland, Wash.
GAS LEAKAGE TEST OF THE PROCESS UNIT. Acceptance Test Procedures 1301-KE. H. S. Davis. Aug. 13, 1953. 11p. Project CA-512-R. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Acceptance test procedures for the biological shield of Hanford Production Reactor (KE) are given. (T.R.H.)

12011 AECU-3325
Hanford Atomic Products Operation, Richland, Wash.
PRESSURE AND VACUUM SEAL TANKS. Acceptance Test Procedure 1302-KE. N. Yutani. Oct. 27, 1953. 10p. Project CA-512-R. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

An acceptance test procedure for checking the pressure and vacuum seal tanks of the gas system of Hanford Production Reactor (KE) for proper fabrication and installation. (T.R.H.)

12012 AECU-3336
Internuclear Co., Clayton, Mo.
DISCUSSION OF HOMOGENEOUS REACTOR POSSIBILITIES. Kenneth A. Hub. May 16, 1956. 5p. A-1 Project. (IC-KAH-56-5). $1.80(ph OTS); $1.80(mf OTS).

A discussion is presented of possibilities for using the homogeneous reactor system for food irradiation. (W.L.H.)

12013 AECU-3338
Internuclear Co., Slayton, Mo.
HOMOGENEOUS REACTOR CIRCULATING FUEL SYSTEM AS A GAMMA SOURCE. Kenneth A. Hub. June 5, 1956. 4p. A-1 Project. (IC-KAH-56-6). $1.80(ph OTS); $1.80 (mf OTS).

The employment of a homogeneous reactor fuel circulating system as a gamma source for food irradiation is hampered by the presence of a neutron flux. Methods for reducing this flux are considered. (D.E.B.)

12014 AECU-3347
Internuclear Co., Clayton, Mo.
NUCLEAR CONSIDERATIONS ON THE USE OF Na IN BeO AND GRAPHITE CORES AS A POTENTIAL GAMMA SOURCE. Glen E. Putnam. July 2, 1956. 31p. A-1 Project. (IC-GEP-56-14). $4.80(ph OTS); $2.70(mf OTS).

Due to the high gamma energy obtained per disintegration of Na^{24}, a reactor system employing sodium as the parent material for a gamma irradiation facility is of interest. Two tentative schemes are examined in this memo. Molten Na is used as the coolant and parent material in reactors using highly enriched U as fuel and BeO or graphite as moderator. The Na is activated in the core and the measure of the efficiency of activation is Z, the number of absorptions in Na per U^{235} absorption. All of the activations are assumed to occur in the reactor core. The BeO and the graphite reactors are studied separately under similar assumptions regarding U^{235} burnup, fuel element design, and criticality aspects. The major results are presented in tabular and graphical form with emphasis on the reactor properties represented by the U loading needed (the initial critical mass), the Z, and the sodium volume contained in the reactor core. (auth)

12015 AERE-9ER/3
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
HEAT TRANSFER PROBLEMS IN URANIUM RODS. J. Woodrow. May 1, 1947. 7p.

The results of five investigations into the temperature distribution in uranium rods, with non-uniform surface coefficients of heat transfer due to imperfect canning, or incomplete finning of the can are reported. The five cases investigated are those for which contact between a U rod and Al can, exists round only a half of the circumference, at all sections along the rod, contact between rod and can exists over three quarters of the circumference, at all sections along the rod, contact between rod and can does not occur over a circular patch, finning introduced to increase heat transfer does not extend up to the ends of the rod; a rise in temperature must therefore occur in the unfinned portions, when the pile is run at the higher rating made possible by finning, and cavities up to 0.025 in. in diameter have been found to exist in U rods. The effect these cavities have on temperature distribution is investigated. (auth)

12016 BNL-175
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] MARCH 1952. R. W. Powell. Decl. Sept. 21, 1956. 19p. $3.30(ph OTS); $2.40(mf OTS).

(For preceding period see BNL-165.)

12017 BNL-193
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] JULY 1952. R. W. Powell. Decl. Sept. 21, 1956. 20p. $3.30(ph OTS); $2.40(mf OTS).

12018 BNL-241
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] MAY 1953. R. W. Powell. Decl. Sept. 21, 1956. 24p. $4.80(ph OTS); $2.70(mf OTS).

(For preceding period see BNL-238.)

12019 BNL-286
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] FEBRUARY 1954. R. W. Powell. Decl. Sept. 21,

1956. 18p. $3.30(ph OTS); $2.40(mf OTS).

The operation and performance of the Brookhaven Reactor are summarized. Miscellaneous data are included. (For preceding period see BNL-283.) (W.L.H.)

12020 BNL-295

Brookhaven National Lab., Upton, N. Y.

REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] APRIL 1954. R. W. Powell. Decl. Sept. 21, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).

(For preceding period see BNL-291.)

12021 BNL-304

Brookhaven National Lab., Upton, N. Y.

REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] JUNE 1954. R. W. Powell. Decl. Sept. 21, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).

(For preceding period see BNL-300.)

12022 BNL-313

Brookhaven National Lab., Upton, N. Y.

REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] SEPTEMBER 1954. R. W. Powell. Decl. Sept. 21, 1956. 19p. $3.30(ph OTS); $2.40(mf OTS).

(For preceding period see BNL-310.)

12023 CRRP-656

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

EFFECT OF FLUX FLATTENING ON PILE POWER. M. F. Duret and W. J. Henderson. July 25, 1956. 23p. (AECL-347).

The flux distribution in a cylindrical reactor with three annular zones has been studied using an electronic analog computer, to determine how the power output is related to the flux shape. The outside zone is an infinite H_2O reflector, and the core consists of two zones, each a lattice of NRU rods. The innermost region has the smaller lattice spacing of the two. This arrangement tends to flatten the flux. The degree of flux flattening is studied as a function of the radius of the central zone, the radius of the reactor core, and the lattice spacing in the intermediate zone. Flattening the flux with a 2 zone core has the following results: the reactor power is increased, the fuel inventory is decreased, and the neutron leakage is increased. (auth)

12024 KAPL-1594

Knolls Atomic Power Lab., Schenectady, N. Y.

A XENON CALCULATION PROCEDURE ADAPTABLE TO DIGITAL COMPUTERS. P. L. Hofmann, H. Hurwitz, Jr., and E. Wachspress. Aug. 1, 1956. 21p. Contract W-31-109-Eng-52. $0.25(OTS).

A summary is presented of the digital computer procedure used at KAPL for the determination of the Xe concentration and its effect on reactivity during reactor operation and after shutdown. The techniques outlined were devised to be particularly applicable to intermediate spectrum reactors similar to the S1G/S2G. In general, the approach has relied—as far as terminology and formalism are concerned—on multigroup calculation methods as practiced at KAPL. Particular emphasis has been placed on steady state operation and peak xenon override. For both of these conditions methods are described for calculating the Xe concentration and its effect on reactivity. (auth)

12025 KAPL-M-HES-19

Knolls Atomic Power Lab., Schenectady, N. Y.

THREE-GROUP ADJOINT CALCULATIONS. H. E. Stone. May 9, 1956. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Adjoint flux calculations are required in the application of perturbation theory to calculate effects on reactivity due to reactor changes resulting from effects of temperature changes or local introduction of fuel or poison. A method is discussed by which adjoint fluxes can be readily obtained with the use of the presently existing three-group code, MUG-II. Temperature coefficient calculations as a function of position in the reactor, employing adjacent fluxes calculated by the above method, are now in progress. (auth)

12026 NAA-SR-1690

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SODIUM GRAPHITE REACTOR QUARTERLY PROGRESS REPORT [FOR] APRIL–JUNE 1956. L. E. Glasgow, ed. Sept. 15, 1956. 67p. Contract AT(04-3)-49. $0.40(OTS).

Technology of the Sodium Graphite Reactor. Nuclear parameters were calculated for a lattice having cylindrical moderator cans. Design, development, and fabrication progress on SRE hot cells are reviewed. Solid and hollow U–Mo fuel slug fabrication experience is reported. Breeder material and graphite studies were continued. Additional information on the behavior of Zr and Zr–Ti alloys in liquid Na is given. Sodium Reactor Experiment. Core tank stresses as a function of time after shutdown were plotted. The status of plant construction is shown. Cooling system component testing was continued. Test equipment and results are shown. Further testing of the control rod mechanism is reported. Calculated values of required shield thicknesses are plotted. (For preceding period see NAA-SR-1622.) (D.E.B.)

12027 NPG-9(AECL)

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

DESIGN OF A HEAD AND KEYED CLOSURE FOR A NUCLEAR REACTOR PRESSURE VESSEL. W. H. Bowes. May 30, 1956. 37p. (AECL-349).

A design study was carried out to determine the feasibility of engineering a welded, penetrated vessel head, and of securing the head by means of helical keys. The fuel rod pitch, core diameter and internal pressure used in the design were proposed for N.P.D. at the time this study was started. These values have since been altered: diameter and spacing have been increased, pressure reduced. The welded head and keyed closure are feasible for the given design conditions. It is probable that a similar vessel could be designed to meet the present requirements of N.P.D. (auth)

12028 WAPD-149

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

ESCAPE PROBABILITY AND CAPTURE FRACTION FOR GRAY SLABS. D. Schiff and S. Stein. June 1956. 43p. Contract AT-11-1-GEN-14. $0.30(OTS).

The escape probability and capture fraction in isotropically scattering and absorbing convex bodies are defined and related. Numerical results for slabs, obtained from digital integration of the transport equation, are given for optical depths in the range $0.2 \leq 2t \cdot \Sigma_T \leq 100$ and scattering probabilities in the range $0 \leq \Sigma_s / \Sigma_T \ (0.1) \leq 0.9$. (auth)

12029 WAPD-A1W(PCh)-18

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

PREDICTED A1W PRIMARY WATER CONDITIONS. Yale Solomon and Paul E. Brown. [Dec. 1955]. 9p.

Water conditions in a carbon steel Carrier Vessel Reactor plant have been examined for a variety of operating conditions including start-up, normal operation, occasional deviations from normal operation, and for certain casualty situations. These operating conditions have been considered for three types of feedwater: deaerated, deoxygenated, and non-deaerated. Water condi-

tions for component design, testing, and equipment specification are given. (W.L.H.)

12030 WAPD-TH-204

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

BOILING PRESSURE DROP IN RECTANGULAR CHANNELS. H. S. Jacket, J. D. Roarty, and N. C. Sher. May 7, 1956. 22p. $3.30(ph OTS); $2.40(mf OTS).

A considerable amount of bulk boiling pressure drop data has been obtained from vertical, rectangular, Zircaloy-2 channels at 2000 psia along with additional heating and local boiling results. The over-all ranges of test conditions have been extended to include mass velocities from 0.7×10^6 to 5.0×10^6 lb/hr-ft^2, inlet temperatures from 400 to 625°F, heat fluxes as high as 1.0×10^6 Btu/hr-ft^2 and exit qualities as high as 40%. Nine 27 in. × 1 in. × 0.097 in. and two 27 in. × 1 in. × 0.050 in. test sections have been used; however, only 11 runs were performed in the smaller channels. Test conditions existing during each run are presented. (auth)

12031 WAPD-TM-6

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

FEW GROUP CONSTANTS FOR DELAYED NEUTRONS. Lionel Friedman. June 1956. 42p. Contract AT-11-1-GEN-14. $0.30(OTS).

The results of multigroup Fourier transform calculations for delayed neutrons are presented. The few group constants, in general, are D_f, fast diffusion constant; Σ_R, fast removal cross section; Σ_a, fast absorption cross section; T, the age; p, resonance escape probability; and $\nu\Sigma_f$, the product of the fast fission cross section and the average number of neutrons emitted in fission per fast fission. Results for slowing-down media of pure H_2, H_2O, $Zr-H_2O$ mixtures, and $U-H_2O$ mixtures (both 235 and 238) are given. These results are formulated for both one and two slowing-down groups, the latter fitting into the three slowing-down group scheme for regular prompt neutrons. From these data, fitted one- and two-velocity microscopic cross sections are inferred for H_2, O_2, Zr, U^{238}, and U^{235} (auth)

12032

INDUSTRY AND THE NUCLEAR POWER REACTOR PROGRAM. Chem. Eng. Progr. 52, 94(1956) June.

Industry and the AEC in the work towards the complete commercial development of nuclear power are discussed. A table is given of the reactors already proposed. (J.H.M.)

12033

INSTRUMENTATION PROBLEMS OF PRODUCTION REACTORS. Thomas R. Vick Roy (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Chem. Eng. Progr. 52, 233-7(1956) June.

The following examples of control systems are described through schematics and discussions: monitoring flow in reactor cooling channels; monitoring temperature in the same channels; measuring the relative motion of reactor ports due to thermal expansion; and control of liquid level in a tank. (J.H.M.)

12034

ECONOMIC ATOMIC POWER DEPENDS ON MATERIALS OF CONSTRUCTION. John H. Frye, Jr. and James L. Gregg (Oak Ridge National Lab., Tenn.). Metal Progr. 70, No. 3, 92-6(1956) Sept.

A study is made of the possibility of building a breeder reactor using U^{233} and a Th blanket for generating heat at costs comparable to steam boilers using coal. (J.E.D.)

12035

POWER REACTOR PROGRAMS IN THE U. S. Metal Progr. 70, No. 3, 96-B(1956) Sept.

12036

FISSION-PRODUCT BUILDUP IN ENRICHED THERMAL REACTORS. Robert W. Deutsch (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 14, No. 9, 89-91 (1956) Sept.

The calculations for obtaining data to plot fission product poisoning vs. fuel burnup in enriched fuel thermal reactors are shown. The nuclide yields and cross sections used are tabulated. The graphs are useful in evaluating poisoning effects in long-burning reactors. There is some uncertainty due to lack of cross section data for Sm. (T.R.H.)

12037

COMPACT, LOW-COST REACTOR EMPHASIZES SAFETY. A. T. Biehl, R. Fayram, R. Henley, G. A. Linenberger, H. Montgomery, R. Mainhardt, G. Newby, J. Randall, D. Sawle, and J. Sherwin (Aerojet-General Nucleonics, San Ramon, Calif.). Nucleonics 14, No. 9, 100-3(1956) Sept.

The AGN-201, a small research reactor for use in educational, medical, industrial, and other research institutions, is described. It is a 100 MW minimum-critical-mass reactor, 6½ ft in diameter, 9 ft high, and weighing a total of 22,000 lb. It is intended for applications where low cost, low thermal-neutron flux, maximum safety, high sensitivity, and portability are the main considerations. (T.R.H.)

12038

VALVES AND CORKS TO SEAL REACTOR SHIELDS. C. V. Moore (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 14, No. 9, 134-8(1956) Sept.

The advantages and disadvantages of corks and valves for stopping up holes in reactor shields and in the service machines are presented. Several types of each are pictured and described. (T.R.H.)

12039

THE ECONOMICS OF SMALL NUCLEAR POWER UNITS. J. M. Kay. Nuclear Eng. 1, 225-7(1956) Sept.

A large-scale power program will probably be based on a mixture of reactor types using natural and enriched U. There is evidence to suggest that a small reactor power plant may soon be competitive with Diesel units where fuel costs are high. (auth)

12040

THE WORLD'S REACTORS. NO. 5. ZEUS. Nuclear Eng. 1, 234a(1956) Sept.

A data sheet with specifications and cutaway view of ZEUS, a fast heterogeneous reactor for Dounreay, is given. (F.S.)

12041

FIRST COMMERCIAL PRESSURIZED WATER REACTOR. Nuclear Eng. 1, 241-4(1956) Sept.

On May 4 the U.S.A.E.C. officially approved plans for the construction of a privately owned and operated reactor power station with an installed capacity of 236 Mw. The station is due to go into operation some time in 1960. (auth)

12042

SCIENTIFIC PROBLEMS IN THE DEVELOPMENT OF NUCLEAR POWER. John Cockcroft (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Power 1, 200-4(1956) Sept.

Scientific problems surveyed are those of reactor physics, solid state physics and chemistry. The prospect of high burnups and the conversion of Pu^{239} to Pu^{240} and Pu^{241} has led o a study of these isotopes. Slight enrichment of fuel for gas-cooled, graphite-moderated reactors is believed to be economical and burnups of 10,000 MWD/t are expected ultimately. On fast Pu reactors, breeding gains of 1.6 to 1.7

are expected. The most difficult problem is the development of a reliable fuel element, but radiation problems of great difficulty occur with all reactor materials. Compatibility problems between fuels, moderators, and coolants are discussed and a new Al alloy is reported. Pyro-metallurgical methods for the processing of irradiated elements show promise and will probably be used for fast reactors. (auth)

12043

THE SAFETY OF REACTOR CONTROL SCHEMES. J. Walker (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Power 1, 205-9(1956) Sept.

The safety system of a nuclear reactor must be designed so that the maximum possible reactivity conceivable under any combination of fault conditions can be removed and the reactor brought sub-critical before any catastrophic situation is reached. This is generally achieved by the primary shut-off system backed by a secondary or safety system. A third independent system, controlled by some reactor variable such as fuel temperature is also recommended. The form these controls should take is discussed and the system used in the DIDO reactor at Harwell is described. The importance of power measurement down to the lowest levels is emphasized and factors affecting the design and location of ionization chambers and neutron counters are considered. (auth)

12044

HEAT RECOVERY FROM REACTORS. P. Chambadal and J. P. Roux. Nuclear Power 1, 211-15(1956) Sept.

Heat from a nuclear reactor may be used to raise steam either alone on in combination with an external source of fuel heat. In addition, the heat can be supplied either to water or to the steam. Thus, four possible methods of steam raising are possible. A very promising method is that of using nuclear heat only for feed water heating, with a conventionally fired boiler supplying evaporation and superheat. It is shown that this is thermodynamically equivalent to continuous feed heating by bled steam. Another method is by using flash steam boilers in cascade. A description of the power plants of the French G1, G2 and G3 reactors at Marcoule is included. (auth)

12045

NUCLEAR POWER FOR COMMERCIAL VESSELS. IV. K. Maddocks (Univ. of Michigan, Ann Arbor). Atomics 7, 309-14(1956) Sept.

A survey is presented of British and American unclassified material relative to the use of nuclear power for marine propulsion. Following a brief discussion on the principles of fission and reactor operation, five types of reactor suitable for marine use and one type suitable for fuel production are described and illustrated. The gas cooled reactor is selected as most suitable for marine propulsion and a proposed closed cycle gas turbine plant is analysed in some detail. Various proposals for the use of nuclear power in specific ships are reviewed, and an economic analysis is made to compare a 30,000 ton d.w. tanker when operating with an oil fired steam turbine plant and when operating with a nuclear-powered closed-cycle helium turbine. The first parts of this article appeared in the May, June and August issues. (auth)

Refer also to abstract 11941.

NUCLEAR TRANSFORMATION

12046 AECU-3343

Internuclear Co., Clayton, Mo.

PHOTONEUTRONS IN FOOD IRRADIATED BY Na^{24}. D. T. Bray. May 9, 1956. 14p. A-1 Project. (IC-DTB-56-10). $3.30(ph OTS); $2.40(mf OTS).

When Na^{24} decays, it emits a 2.76- and 1.38-Mev γ in cascade. The 2.76-Mev γ is above the 2.17-Mev threshold for the production of photoneutrons from deuterium. Since most foods contain water with its naturally occurring percentage of deuterium, neutrons will be produced in the food when Na^{24} is used as a γ source for food irradiations. This memo discusses some of the problems involved. (auth)

12047

THE RELATIVE YIELDS OF THE ISOTOPES OF XENON IN PLUTONIUM FISSION. W. H. Fleming and H. G. Thode (McMaster Univ., Hamilton, Ont., Canada). Can. J. Chem. 34, 193-200(1956) Mar.

The relative fission yields of 5 isotopes of Xe in Pu^{239} fission have been determined. Fine structure, similar to that observed in U^{238} fission but smaller, occurs in Pu fission in the xenon mass range. The yield of the 133 mass chain has been determined at xenon in order to permit the normalization of the relative xenon yields to the relative cesium yields. (auth)

12048

THE YIELD OF Cs^{138} IN THERMAL NEUTRON FISSION OF U^{235}. Rosalie M. Bartholomew and A. P. Baerg (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem. 34, 201-5(1956) Mar.

The yield of Cs^{138} in thermal neutron fission of U^{235} has been investigated using the 4π counting technique. The value obtained for the fission yield is (7.22 ± 0.29)% based on a value of 6.32% for the fission yield of Ba^{140}. The half life of Cs^{138} was determined and found to be 32.2 ± 0.1 min. (auth)

12049

SOME CUMULATIVE YIELDS OF ISOTOPES FORMED IN THE THERMAL NEUTRON FISSION OF Pu^{239}. D. M. Wiles, J. A. Petruska, and R. H. Tomlinson (McMaster Univ., Hamilton, Ont., Canada). Can. J. Chem. 34, 227-32(1956) Mar.

The relative yields of the isotopes of Cs, Ce, Nd, and Sm, produced by the thermal neutron fission of Pu^{239} have been determined with a mass spectrometer. Preliminary values of the absolute yields of 16 isotopes of these elements together with four yields of the xenon isotopes have been assigned by means of isotope dilution techniques. (auth)

12050

THE RATIO OF XENON TO KRYPTON IN U^{235} FISSION. A. T. Blades, W. H. Fleming, and H. G. Thode (McMaster Univ., Hamilton, Ont., Canada). Can. J. Chem. 34, 233-7 (1956) Mar.

The ratio of the yield of Kr^{86} to the yield of Xe^{134} in U^{235} fission is 0.257 ± .005 determined by isotope dilution techniques. The corresponding yield ratio of total xenon to total krypton in the thermal neutron fission of U^{235} is 5.52 ± .10. (auth)

12051

THE YIELDS OF ^{129}I IN NATURAL AND IN NEUTRON-INDUCED FISSION OF URANIUM. B. C. Purkayastha and G. R. Martin (Univ. of Durham, England). Can. J. Chem. 34, 293-300(1956) Mar.

Measurements have been made, by a radioactivation technique, of the I^{129} formed in U by pile-neutron-induced fission, and in pitchblende by the natural fission of U. The amount found in the pile-neutron-irradiated U corresponds to a fission yield of 0.90% at mass 129. The natural production of I^{129} in pitchblende is discussed in the light of the mass-spectrometric measurements of spontaneous fission xenon made by Thode and his collaborators. An upper limit of 1 part in 10^8 can be set for the occurrence of I^{129} in natural iodine. The pile neutron capture cross section of I^{129} has been measured as 35 barns. (auth)

12052

CHEMICAL EFFECTS OF THE NUCLEAR TRANSFORMATION $N^{14}(n,p)C^{14}$. Peter E. Yankwich (Univ. of Illinois, Urbana). Can. J. Chem. 34, 301-9(1956) Mar.

The physical and chemical behavior of energetic carbon particles in ionic lattices is investigated. Models of the process due to Libby and to Seitz and Koehler are compared for simple and complex ionic crystals. For simple crystals the models lead to practically identical chemical predictions; where polyatomic ions are present, the Seitz-Koehler model appears to give a more satisfactory account of the distribution of radiocarbon over various product species. (auth)

12053

ANGULAR DISTRIBUTION OF FRAGMENTS FROM NEUTRON-INDUCED FISSION OF U^{238} AND Th^{232}. R. L. Henkel and J. E. Brolley, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 1292-5(1956) Sept. 1.

The angular anisotropy of neutron-induced fission in Th^{232} and U^{238} has been investigated with a double fission chamber whose common center high-voltage electrode was also a collimator. Ratios of $\sigma_F(0°,E_n)/\sigma_F(90°,E_n)$ were measured at a number of neutron energies from the tresholds near 1 Mev to 20 Mev. Larger variations were found in the anisotropy of fission fragments for U^{238} and Th^{232} than in earlier measurements for other nuclei, particularly at neutron energies immediately above the fission thresholds. For Th^{232}, there seems to be direct correlation between the variations in the anisotropy and those in the fission cross section. At 1.6 Mev, corresponding to a peak in the Th^{232} fission cross section, the angular distribution of fission fragments showed a maximum at 90° to the neutron direction. All previous measurements have shown maxima along the neutron direction. (auth)

12054

ANGULAR DISTRIBUTION OF FISSION FRAGMENTS AT THRESHOLD ACCORDING TO THE BOHR MODEL. Lawrence Wilets and David M. Chase (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 1296-7(1956) Sept. 1.

The sideways-peaked angular distribution of fragments from neutron-induced fission of Th^{232} near threshold, measured by Brolley and Henkel, is found to be consistent with the model of A. Bohr. It is assumed that the saddle-point states through which the fissioning nucleus passes include primarily only a few members of a particular rotational band. Indications are adduced that this band has $K = 3/2$ and odd parity. (auth)

12055

COMPOUND NUCLEUS EFFECTS IN DEUTERON REACTIONS: $B^{10}(d,p)B^{11}$ AND $B^{10}(d,\alpha)Be^{8}$. Jerry B. Marion and Gustav Weber (California Inst. of Tech., Pasadena). Phys. Rev. 103, 1408-13(1956) Sept. 1.

Angular distributions and excitation curves have been measured in the energy range $E_d = 0.9$ to 3.0 Mev for the four highest energy proton groups from the $B^{10}(d,p)B^{11}$ reaction and for the ground state α-particle group from the $B^{10}(d,\alpha)Be^{8}$ reaction. Several broad resonances were observed in the excitation curves, but the shapes of the curves obtained for the various particle groups differ considerably. Resonance effects are most pronounced for the ground state proton group, whereas the group leading to the third excited state of B^{11} shows no resonance behavior. The (d,p) angular distributions suggest that compound nucleus formation plays an important role at these low bombarding energies. In particular, the stripping peak in the angular distribution of the ground state proton group (p_0) does not begin to take shape until $E_d \gtrsim 2$ Mev, while the p_1 distributions do not indicate a stripping peak at any energy. It is suggested that a shell-model effect is responsible for the lack of stripping in the case of the p_1 group. At $E_d = 2.9$ Mev, the p_2 angular distribution is almost symmetric about $\theta(cm) = 90°$ while the p_3 distribution shows a fairly well developed $l_n = 1$ stripping peak. The α-particle excitation curves indicate that forward-backward asymmetries in the angular distributions are averaged out when the energy interval $E_d = 1$ to 2.5 Mev is considered, in accordance with the statistical model prediction. (auth)

12056

ANGULAR DISTRIBUTION OF 16.1-MEV GAMMA RAYS FROM THE 163-KEV RESONANCE IN THE REACTION $B^{11}(p,\gamma)C^{12}$. D. S. Craig, W. G. Cross, and R. G. Jarvis (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 103, 1414-17(1956) Sept. 1.

The relative thick-target yield, at a bombarding energy of 168 kev, of 16.1-Mev gamma rays from the reaction $B^{11}(p,\gamma)C^{12}$ has been measured at 0, 60, 90, and 120 degrees. The angular distribution is of the form $1 - A\cos\theta + B\cos^2\theta$, with $A = 0.19 \pm 0.06$ and $B - A = 0.02 \pm 0.04$. The $\cos\theta$ term is believed to be caused by interference between a resonance of spin and parity 1− at a bombarding energy of 1.4 Mev, and the resonance of spin and parity 2+ at a bombarding energy of 163 kev. (auth)

12057

NEUTRAL PION PRODUCTION IN DEUTERIUM AND HYDROGEN: RATIOS. J. C. Keck, A. V. Tollestrup, and H. H. Bingham (California Inst. of Tech., Pasadena). Phys. Rev. 103, 1549-57(1956) Sept. 1.

Neutral photopion production in deuterium and hydrogen has been studied by counting the decay photons singly. Pure gas targets were used. The photon counter consisted of three counters, the first in anticoincidence and the second and third in coincidence. The photon counting rate was obtained by taking the difference between the counting rates with a Pb converter alternately behind and in front of the anticoincidence counter. Data were obtained for 300-, 400-, and 500-Mev bremsstrahlung at laboratory angles of 30, 73, and 140°. An attempt to apply the photo-difference method was only moderately successful owing to poor control of the bremsstrahlung end point and the unfavorable shape of the neutral pion excitation curve. At 73° and 140° the data are consistent with a constant value of 0.90 per nucleon for the deuterium-to-hydrogen neutral photopion production ratio. At 30° and 300 Mev there is some evidence for a larger ratio, which points to constructive interference between production on the proton and neutron in the deuteron. The data are consistent with the predictions of the "symmetrical theory" concerning the coupling of neutral pions to nucleons and with Watson's phenomenological theory of photopion production. (auth)

12058

SUCCESSIVE NEUTRON CAPTURE IN Tb^{159}. R. R. Smith, S. D. Reeder, and R. H. Lewis (Phillips Petroleum Co., Idaho Falls, Idaho). J. Chem. Phys. 25, 502-4(1956) Sept.

The presence of a 6.8-day activity having a chemical nature similar to or identical with that of Tb has been observed in a sample of Tb_4O_7 irradiated in a high neutron flux in the Materials Testing Reactor. This activity is believed to be that of Tb^{161} formed by secondary neutron capture in Tb^{159}. Measurements of the relative beta intensities of the first and second order species have been made and lead to a value of 525 ± 100 barns for the pile neutron absorption cross section of Tb^{160}. (auth)

12059

THE ANGULAR DISTRIBUTION OF α-PARTICLES FROM THE REACTION $^{19}F(p\alpha)^{16}O^*(\pi)^{16}O$. Akira Isoya, Kazuo Goto, and Teruo Momota (Univ. of Tokyo). J. Phys. Soc. Japan 11, 899-906(1956) Sept.

The angular distribution of α particles from the reaction

$^{19}F(p\alpha)^{16}O^*(\pi)^{16}O$ has been measured at fourteen energies between 800 kev and 1400 kev. The α particles were detected and identified by coincidence with nuclear pair electrons. The data were analyzed to give coefficients in the expansion formula $\sigma(\theta) = a_0 + a_1 \cos\theta + a_2 \cos^2\theta + a_3 \cos^3\theta + a_4 \cos^4\theta$. The spins of the levels of the compound nucleus Ne^{20} were assigned from the evidence of anomalies in the coefficients. For the resonances at 843, 1126, and 1355 kev, J = 2 and for that at 1250 kev, J = 1. (auth)

Refer also to abstract 12001.

PARTICLE ACCELERATORS

12060 ANL-5615
Argonne National Lab., Lemont, Ill.
THE SOVIET 10-BEV PROTON SYNCHROTRON. John Marshall. Sept. 1956. 21p. Contract W-31-109-eng-38. $0.25(OTS).

Available information was scanned to determine as accurately as possible the design and operating characteristics of the Soviet 10-Bev proton synchrotron. (D.E.B.)

12061 NYO-7676
Rochester, N. Y. Univ.
ON THE EFFECT OF SECTOR FLARE IN FIXED FIELD SEGMENTED ACCELERATORS. F. Salzman and A. Roberts. Aug. 27, 1956. 23p. Contract AT(30-1)-875. $4.80(ph OTS); $2.70(mf OTS).

The effect of varying the angular width of the sectors in a segmented circular accelerator is examined. It is shown that in an isochronous (constant-frequency) accelerator the flare has no effect on the betatron frequencies in the approximation of a very large number of sectors. In general flare may be substituted for gradient in its effect on focusing. Examples of accelerators with uniform magnetic fields and flare-focusing are given. (auth)

12062 ORNL-2139
Oak Ridge National Lab., Tenn.
ELECTRONUCLEAR RESEARCH DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING MARCH 20, 1956. F. T. Howard, ed. Oct. 3, 1956. 23p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The ORNL 63-in. cyclotron was operated routinely; 26-Mev N^{3+} ions were used in a study of nitrogen-induced reactions on Na^{23}, and the light-particle spectrometer was used in an investigation of the energy distribution of alpha particles induced by nitrogen on several light elements. The beam-deflector system of the 86-in. cyclotron was placed in operation; the proton beam is now either used at high current for bombarding internal isotope-production targets or deflected to basic research targets up to 32 ft from the cyclotron. The resonant system of the 48-in. heavy-particle cyclotron was test-operated; until a new magnet is built, it will be used to accelerate protons to ~5 Mev. Studies are continuing on the development of plans for a fixed-frequency cyclotron with an azimuthally varying magnetic field to operate in the 1-Bev energy range; a cyclotron analogue is being constructed for the study of associated resonance problems. Additional quantities of Pu isotopes were enriched and placed in inventory; additional high-level feed was obtained for future processing. (auth)

12063
A VERSATILE VAN DE GRAAFF. FLEXIBLE OPERATION A FEATURE OF NEW S.T.L. UNIT. Nuclear Eng. 1, 250-1(1956) Sept.

Five different types of radiation beams, (electrons, protons, deuterons, neutrons, and high speed x rays) are available from the Van de Graaff machine at Enfield. The machine will produce short-lived isotopes but will mainly be used for work on solid state research, semiconductors, and dielectrics. (F.S.)

12064
ELECTRON ACCELERATOR USED FOR PRODUCING NEUTRONS. Alfred J. Moses and Jerome Saldick (General Electric Co., Cincinnati, Ohio). Nucleonics 14, No. 9, 118-19(1956) Sept.

The use of a Van de Graaff electron accelerator to produce thermal-neutron fluxes of 8.5×10^{-6} neutrons/cm^2/sec is described. Its applications and performance are discussed. (T.R.H.)

Refer also to abstract 11973.

RADIATION ABSORPTION AND SCATTERING

12065 AECU-3333
Internuclear Co., Clayton, Mo.
GAMMA ATTENUATION IN TARGETS IRRADIATED BY SLAB SOURCES. William R. Pearce. May 28, 1956. 28p. A-1 Project. (IC-WRP-56-3). $4.80(ph OTS); $2.70(mf OTS).

Higher irradiation efficiency is obtained through the use of thin sources and thick targets. More uniform dose rates are obtained by decreasing source slab thickness and radius, off-axis geometry, and the addition of a second gamma activity. A specific multienergy problem is examined for In gammas and slab geometry. (D.E.B.)

12066 AECU-3335
Internuclear Co., Clayton, Mo.
GAMMA ATTENUATION IN EXTERNALLY IRRADIATED CYLINDRICAL TARGETS AND GAMMA FLUX DISTRIBUTIONS WITHIN CYLINDRICAL SOURCES. William R. Pearce. June 5, 1956. Includes Supplement 1. June 18, 1956. And Supplement 2. June 21, 1956. 17p. A-1 Project. (IC-WRP-56-4; IC-WRP-56-4(Suppl. 1); IC-WRP-56-4(Suppl. 2)). $3.30(ph OTS); $2.40(mf OTS).

The gamma flux distribution within a long cylindrical target surrounded by a uniform source and the gamma flux distribution within a cylindrical source were investigated. In either case the expression for flux is directly integrable only on the axis of the cylinder. Calculation of off-axis fluxes or minimum to maximum dose ratios within a target require numerical integration for specific cases. (auth)

12067 ANL-5618
Argonne National Lab., Lemont, Ill.
INVESTIGATION OF NEUTRON SCATTERING FOR THE COMPLEX POTENTIAL MODEL. Jack Sokoloff. Aug. 1956. 193p. Contract W-31-109-eng-38. $1.00(OTS).

A modification and reinterpretation of the Feshbach-Porter-Weisskopf model is used in an attempt to theoretically interpret experimental scattering data obtained by Langsdorf and Lane at Argonne. These data contain neutron differential scattering coefficients for a fairly complete mass spectrum in the range 50 to 1700 kev. A variational method is used in obtaining the square-well phase shifts of all orders in closed form. (D.E.B.)

12068
INELASTIC SCATTERING OF PROTONS FROM ISOTOPES OF Sc, Mn, Fe, Ni, AND Cu. P. M. Windham, C. R. Gossett, G. C. Phillips, and J. P. Schiffer (Rice Inst., Houston, Tex.). Phys. Rev. 103, 1321-6(1956) Sept. 1.

The inelastic scattering of protons from eight nuclides has been studied using a precision 180° magnetic spectrometer. Energy levels in these nuclides were obtained to about 1.6 Mev of excitation. Proton energies of 4.4 to 5.7

Mev were used from the Rice Institute Van de Graaff accelerator. Cross sections for the inelastic scattering processes were obtained. (auth)

12069

p-He^3 SCATTERING AT 9.75-MEV PROTON ENERGY. Ralph H. Lovberg (Univ. of Minnesota, Minneapolis). Phys. Rev. 103, 1393-7(1956) Sept. 1.

The differential cross section for the elastic scattering of 9.75-Mev protons from He^3 has been measured in the range of center-of-mass angles from 30 to 150 degrees. The cross section varies from 345 millibarns/steradian at 30 degrees, through a minimum of 18.2 mb at 110 degrees, and rises to 84.5 mb at 150 degrees. Comparison of the data with the distributions calculated theoretically by Swan gives only rough agreement, the closest being for ordinary forces in the four-body system. This conflicts with the good agreement obtained by Swan with the 14-Mev n-T data of Coon et al., in which a symmetric exchange force scheme was clearly preferable. (auth)

12070

ANGULAR DISTRIBUTION OF INELASTICALLY SCATTERED DEUTERONS. James W. Haffner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 103, 1398-1407 (1956) Sept. 1.

A particle selection technique developed in the MIT cyclotron laboratory has been applied to the study of the angular distributions of inelastically scattered deuterons at a bombarding energy of 15 Mev, the angular distributions of the (d,d′) reactions from Li^6 (Q = −2.19 Mev), Li^7 (Q = −4.61 Mev), Be^9 (Q = −2.43 Mev), C^{12} (Q = −4.43 Mev), Mg^{24} (Q = −1.37 Mev), and Al^{27} (Q = −2.23 Mev, Q = −2.75 Mev) were obtained. These data were analyzed according to the nuclear interaction theory of Huby and Newns, the electric interaction theory of Mullin and Guth, and from the standpoint of compound nucleus formation. The behavior of the angular distributions indicates that for small angles (large impact parameters) electric interaction contributes appreciably. However, for large angles (small impact parameters) the nuclear interaction theory fits the data better. Consideration of the cross sections involved favors the nuclear interaction theory. Compound nucleus formation does not appear to play a major role in elastic deuteron scattering. Improved theoretical treatments of the problem should make possible the determination of the spins and parities of nuclear states not easily reached by other reactions. (auth)

12071

p-p INTERACTIONS AT 3 BEV. R. Cester, T. F. Hoang, and A. Kernan (Univ. of Rochester, N. Y.). Phys. Rev. 103, 1443-9(1956) Sept. 1.

Interactions initiated by 3-Bev protons of the Brookhaven Cosmotron were studied by photoemulsion technique. With appropriate criteria, 115 events are attributed to interactions of the incident beam protons with hydrogen nuclei (~55%) and with bound protons of other nuclei (~45%). A detailed analysis allowed the subdivision of the 115 events in categories, according to the number of π mesons ($N \geq 0$) produced in the collision. The ratio of elastic scattering to the total number of events was estimated to be $\sigma_{el}/\sigma_{total} = 0.20_{-0.07}^{+0.04}$. The observed cross section for pure elastic scattering is $\sigma_{el} = 8.9 \pm 1.0$ mb. The percentages of single, double, triple, and quadruple π-meson production are respectively: 34_{-20}^{+22}; 35.6_{-23}^{+20}; 9.6_{-4}^{+6}; $\sim 1.0^{+3.5}$. Among the 20 most probable cases of single π-meson production—the estimated ratio of π^+ to π^0 is $\sigma_{\pi^+}/\sigma_{\pi^0} = 5.3_{-1.4}^{+0.3}$. The experimental results are not in agreement with the Fermi statistical-model theory (in particular the lower limit for the experimental ratio of triple to single production is given by $\sigma_3/\sigma_1 > \sim 1/10$ in contrast with the predicted ratio $\sigma_3/\sigma_1 = 1/67$) but are not inconsistent with the Peaslee excited-state-model theory. (auth)

12072

ELECTRON SCATTERING FROM THE DEUTERON. John A. McIntyre (Stanford Univ., Calif.). Phys. Rev. 103, 1464-71(1956) Sept. 1.

The charge distribution of the deuteron has been studied by electron-scattering experiments using 188-Mev and 400-Mev electrons. Both deuterated-polyethylene foils and deuterium gas targets were used. Two different scattering apparatuses were also used. All experiments are consistent with the following results. The charge of the deuteron is extended over a larger volume than that inferred from low-energy neutron-proton scattering. Specifically, the effective range of the neutron-proton potential is found to be at least $(2.18 \pm 0.15) \times 10^{-13}$ cm as compared with the n-p scattering result of $(1.70 \pm 0.03) \times 10^{-13}$ cm. It is possible also to fit the data using a 1.70×10^{-13} cm effective range, and a deuteron consisting of a point neutron and a proton with an rms radius of $(0.82 \pm 0.17) \times 10^{-13}$ cm. This procedure, however, violates the assumption of the charge independence of the internal structure of nucleons. Finally, the 1.70×10^{-13} cm effective range could be preserved by suitably modifying the Coulomb law at small distances. (auth)

12073

PROTON-PROTON INTERACTIONS AT 810 MEV. T. W. Morris, E. C. Fowler, and J. D. Garrison (Yale Univ., New Haven, Conn.). Phys. Rev. 103, 1472-8(1956) Sept. 1.

244 examples of proton-proton scattering have been observed by using the hydrogen-filled diffusion cloud chamber of the Brookhaven cloud chamber group. The mean energy of the incident protons was measured to be 810 ± 100 Mev. The reactions observed were (1) p + p → p + p, 126 examples, (2) p + p → p + n + π^+, 84 examples, (3) p + p → d + π^+, 1 example, and (4) p + p → p + p + π^0, 5 examples, with 28 examples which can be either reaction (2) or (4). The total proton-proton cross section was determined to be 45 ± 6 mb. The ratio R of the cross section for π^+ production to that for π^0 production is 17 ± 8. An elastic differential distribution strongly peaked in the forward direction was obtained. Angle and momentum distributions of particles and angular correlations between pairs of particles from reaction (2) are presented. No interactions leading to the production of more than one meson or of heavy unstable particles were identified. (auth)

12074

PROTON-PROTON INTERACTIONS AT 1.5 BEV. W. B. Fowler, R. P. Shutt, A. M. Thorndike, and W. L. Whittemore (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1479-83(1956) Sept. 1.

152 interactions of 1.5-Bev protons have been observed in a hydrogen-filled diffusion cloud chamber. The data indicate an elastic cross section of 20 millibarns, with about 22 millibarns cross section for single pion production and 5 millibarns for double pion production. Most single pion production cases are p + p → p + n + π^+; no definite cases of → d + π^+ or → p + p + π^0 were observed. The median elastic scattering angle is 24° in the c.m. system. Inelastic events have pions emitted isotropically with low momenta, nucleons emitted near 0° and 180° with high momenta. The average relative energy (Q value) for the p, π^+ pair is 154 Mev. (auth)

12075

PROTON-PROTON INTERACTIONS AT 2.75 BEV. M. M. Block and E. M. Harth (Duke Univ., Durham, N. C.); V. T. Cocconi and E. Hart (Cornell Univ., Ithaca, N. Y.); and W. B. Fowler, R. P. Shutt, A. M. Thorndike, and W. L.

Whittemore (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1484-9(1956) Sept. 1.

212 interactions of 2.75-Bev protons have been observed in a hydrogen-filled diffusion cloud chamber. The data indicate an elastic cross section of 15 millibarns, with about 9 millibarns cross section for single pion production, 13 millibarns for double, and 4 for triple. There is one example of quadruple pion production. One definite example of the production of heavy unstable particles was observed, and two doubtful cases. The median elastic scattering angle was 19° in the c.m. system. Angle and momentum distributions for inelastic events are consistent with those observed at lower energies. (auth)

12076

INTERPRETATION OF PROTON-PROTON INTERACTIONS AT COSMOTRON ENERGIES. W. B. Fowler, R. P. Shutt, A. M. Thorndike, and W. L. Whittemore (Brookhaven National Lab., Upton, N. Y.); V. T. Cocconi and E. Hart (Cornell Univ., Ithaca, N. Y.); M. M. Block and E. M. Harth (Duke Univ., Durham, N. C.); and E. C. Fowler, J. D. Garrison, and T. W. Morris (Yale Univ., New Haven, Conn.). Phys. Rev. 103, 1489-1501(1956) Sept. 1.

In the absence of numerical predictions based on meson field theory, elastic p-p interactions have been compared with a simple optical model and inelastic ones with statistical theories and considerations based on charge independence. Elastic scattering data are fitted satisfactorily by a spherical interaction region with uniform density, radius 0.93×10^{-13} cm and absorption coefficient from 4.3 to 2.7×10^{13} cm^{-1}. Inelastic interactions provide a confirmatory test of charge independence at 0.81 Bev. Pion multiplicities at 1.5 and 2.75 Bev are higher than predicted by the Fermi statistical theory, but the difference is less than that observed for n-p interactions. The multiplicities observed for p-p interactions are lower than those calculated by Kovacs. Distributions of angle and momentum of particles, and correlation angle and Q values for pairs of particles, in general agree with the predictions of statistical theory at 0.81 Bev and disagree at 1.5 Bev. The data that are not consistent with statistical predictions suggest that a π-nucleon interaction may affect pion production in an important way, but the data are not sufficiently accurate for definite conclusions. (auth)

12077

POLARIZATION IN THE ELASTIC SCATTERING OF DEUTERONS FROM COMPLEX NUCLEI IN THE ENERGY REGION 94 TO 157 MEV. John Baldwin, Owen Chamberlain, Emilio Segrè, Robert Tripp, Clyde Wiegand, and Thomas Ypsilantis (Univ. of California, Berkeley). Phys. Rev. 103, 1502-11(1956) Sept. 1.

The elastic double scattering of deuterons by complex nuclei has been investigated experimentally. Measurements were made on C, Al, and Cu near 157 Mev, on Li, Be, and C near 125 Mev, and on C and Al at 94 Mev. The expected tensor components of the deuteron polarization have not been found. Measurements have been made of the differential cross section and vector-type polarization as a function of angle. The observed polarizations were found to be larger than would be expected on the basis of the individual nucleon-nucleus interactions. (auth)

12078

ON THE DIFFUSION OF RADIATION FROM A POINT OR A LINE SOURCE IN AN INFINITE MEDIUM. J. T. Jefferies (National Standards Lab., Sydney, Australia). Optica Acta 2, 109-11(1955) Oct.

The approximate equation of transfer for diffused radiation in a scattering medium is obtained and applied to the cases of infinite media illuminated by a point source or by an infinite line source of radiation. (auth)

12079

THE INTENSITY AT THE SURFACE OF A SEMI-INFINITE DIFFUSER WITH AN INFINITE LINE SOURCE PARALLEL TO THE SURFACE. R. G. Giovanelli (National Standards Lab., Sydney, Australia). Optica Acta 3, 24-9(1956) Mar.

Equations are developed for the intensity distribution at the surface of a semi-infinite isotropically scattering diffusing medium whose matrix may be of refractive index unity or greater, the source being a line lying on the surface; numerical solutions are given for several values of the albedo for single scattering and hence of the reflectance. An extension of the argument leads to formal solutions for the intensity distribution for line sources below the surface. (auth)

12080

EXPERIMENTS ON LOW-ENERGY ELECTRON SCATTERING AND ENERGY LOSSES. L. Marton (National Bureau of Standards, Washington, D. C.). Revs. Mod. Phys. 28, 172-83(1956) July.

A review is made of the status of experiments which can contribute to the knowledge of the interaction of slow, and moderately slow, free electrons with matter. An investigation was made of characteristic energy losses in solids. The effect of chemical binding on the characteristic electron energy loss is reviewed. Angular distribution of electrons scattered by solids was discussed. Also, scattering and energy losses in gases are included. Emphasis was placed on some of the difficulties, sources of error, and discrepancies in the experiments. (J.H.M.)

12081

COLLECTIVE ENERGY LOSSES IN SOLIDS. David Pines (Princeton Univ., N. J.). Revs. Mod. Phys. 28, 184-98 (1956) July.

Progress which has been made during the past few years toward an understanding of the collective character of certain of the characteristic energy losses observed when fast electrons are scattered by thin solid films is discussed. (J.H.M.)

12082

THEORY OF THE SCATTERING OF SLOW ELECTRONS. H. S. W. Massey (Univ. Coll., London). Revs. Mod. Phys. 28, 199-213(1956) July.

The theory of the scattering of slow electrons is reviewed. Consideration is given the collisions of electrons with H atoms. Some attention is devoted to consideration of the collisions with atoms and ions which results in excitation of levels belonging to the ground configuration. Emphasis throughout the review is placed on the problem of accurately calculating collision cross sections. (J.H.M.)

12083

THE DIFFERENTIAL STOPPING POWER OF LIQUID WATER FOR α-PARTICLES. M. McInally (Edinburgh Univ., England). Proc. Roy. Soc. (London) A237, 28-38 (1956) Sept. 25.

An accurate method is described for determining the differential stopping power of liquid H_2O at α-particle energies between 4 and 6 Mev. Alpha-particles from a Th C′ source pass through a steel capillary tube, whose covered end lies just below the H_2O surface in a wide glass tank. After traversing the H_2O film above the capillary tube the α particles are detected by a movable proportional counter. The curve of count against distance is first plotted. Then the thickness of the H_2O film is increased by adding a weighed quantity of H_2O to the tank and the curve is plotted again. The air equivalent of the added layer of H_2O is then derived from the displacement of the curve. A source of error in the measurements is hysteresis of the angle of contact of the H_2O with the walls of the glass tank, but a correction may be derived by

varying the length of the H_2O–glass–air boundary of the system, or the error may be eliminated by using dilute solutions of detergents. At an α-particle energy of 5.5 Mev, the differential stopping power of one molecule of H_2O relative to the average atom of air is found to be 1.45 ± 0.02, which is 0.02 less than the accepted value for an equivalent mixture of hydrogen and oxygen. The stopping power does not increase by more than 0.02 ± 0.015 between 5.7 and 4.3 Mev. (auth)

Refer also to abstract 11950.

RADIATION EFFECTS

12084 NARF-56-27T
Convair, Fort Worth, Tex.
PROCEDURES FOR SYSTEM PANELS TEST NO. 2. Addendum 1. Aug. 10, 1956. 110p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-122-1).

In this test, existing aircraft systems mounted on test panels will be irradiated, using the Ground Test Reactor as the source. The Ground Test Reactor will be placed in the dry pool, and the panels to be irradiated are grouped around the reactor inside the pool. Measurements will be made of the physical properties and operating characteristics of the panel before, during, and after irradiation. Essentially, the equipment consists of a J-57 turbojet engine, and jet engine hydraulic and electronic systems. (auth)

12085 WADC-TR-55-58(Pt. II)
Goodrich (B. F.) Co. Research Center, Brecksville, Ohio.
A STUDY OF THE EFFECTS OF NUCLEAR RADIATIONS ON ELASTOMERIC COMPOUNDS AND COMPOUNDING MATERIALS. [Period covered] January 1955 to January 1956. John W. Born. Dec. 1955. 86p. Project title: ANPP DEVELOPMENT SUPPORT PROJECT. Task title: RADIATION EFFECTS. Contract AF33(616)-2308.

Continuous stress relaxation measurements in air detail the effects of temperatures ranging from 25 to 80°C on radiation damage to rubber compounds. The order of decreasing resistance to damage is natural rubber, GR-S, Neoprene GN, and Hycar 1002 for gum rubber compounds and GR-S Hycar 1002, natural rubber, and Neoprene GN among the black compounds. Graphs illustrate these results. Stress relaxation measurements, volume swell measurements, infrared absorption analyses, and mass spectral analyses provided fundamental information about radiation damage. They showed further that heat and radiation damage differ significantly. The Anti-Rad screening program and the study of the effect of radiation upon dynamic properties of rubber have reached the physical testing stage. Compounds containing 91 specially-selected potential Anti-Rads have received optimum cures, and samples have undergone gamma irradiation. The purpose of the screening is to provide criteria for the synthesis of specific new Anti-Rads. (auth)

12086 AEC-tr-2582
CHARGE OF ELECTRICAL CONDUCTIVITY OF CERTAIN FERRITES UNDER THE ACTION OF γ-RAYS. N. V. Volkenshtein and A. N. Orlov. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 18, 494-501(1954). 8p.

The electric conductivity of certain ferrites increases upon γ irradiation. The increase is greater at lower temperatures. The relaxation time of the electric conductivity at room temperature is of the order of minutes. The experimental results are discussed. (T.R.H.)

12087
BASIC MECHANISMS. D. S. Billington (Oak Ridge National Lab., Tenn.). Nucleonics 14, No. 9, 54-8(1956) Sept.

Fast neutrons and fission fragments produce 5 types of changes in solids: vacancies, interstitial atoms, very small transient high temperature regions or thermal spikes, impurity atoms, and ionization. The effects of β- and γ-radiation are trivial in comparison. Only qualitative information is available since generalities are few and research facilities unavailable. (T.R.H.)

12088
ENGINEERING USE OF DAMAGE DATA. O. Sisman and J. C. Wilson (Oak Ridge National Lab., Tenn.). Nucleonics 14, No. 9, 58-62(1956) Sept.

The particular variables involved in radiation effects on structural metals, plastics and elastomers, ceramics, fuels and control rods, semiconductors, organic liquids, and liquid metals are pointed out. The type and amount of radiation, environment of the material and initial state of the material are briefly discussed. A frame-work for interpretation of radiation effects data for engineers is outlined. (T.R.H.)

12089
DAMAGING EFFECTS OF RADIATION ON SOLID REACTOR MATERIALS. J. H. Kittel (Argonne National Lab., Lemont, Ill.). Nucleonics 14, No. 9, 63-5(1956) Sept.

The effects of radiation on the engineering properties of solid reactor materials are discussed qualitatively. (T.R.H.)

12090
DAMAGING EFFECTS OF RADIATION ON ELECTRONIC COMPONENTS. R. D. Shelton and J. G. Kenney (Admiral Corp., Chicago). Nucleonics 14, No. 9, 66-9(1956) Sept.

The effects of radiation on conductors, insulators, resistors, capacitors, semiconductors, and vacuum tubes are discussed qualitatively. (T.R.H.)

12091
DAMAGING EFFECTS OF RADIATION ON PLASTICS AND ELASTOMERS. Robert Harrington (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 14, No. 9, 70-4(1956) Sept.

The results of experiments with gamma radiation on some 50 plastics and elastomers are tabulated and discussed. (T.R.H.)

12092
DAMAGING EFFECTS OF RADIATION ON CHEMICAL MATERIALS. J. C. Bresee, J. R. Flanary, J. H. Goode, C. D. Watson, and J. S. Watson (Oak Ridge National Lab., Tenn.). Nucleonics 14, No. 9, 75-81(1956) Sept.

The effects of gamma radiation on protective coatings, gasket materials, asphalts and tars, ion exchange resins, and aqueous solutions are tabulated and discussed. (T.R.H.)

12093
BENEFICIAL EFFECTS OF RADIATION ON POLYMERS. Arthur Charlesby (Tube Investments Research Labs., Cambridge, England). Nucleonics 14, No. 9, 82-5(1956) Sept.

The effects of radiation on physical properties of polymers, with a view to possible commercial applications, are discussed. (T.R.H.)

12094
BENEFICIAL EFFECTS OF RADIATION ON METALS. H. A. Saller (Battelle Memorial Inst., Columbus, Ohio). Nucleonics 14, No. 9, 86-8(1956) Sept.

A qualitative discussion of the improvements effected in the properties of reactor fuels, cladding and structural materials, and of non-reactor structural materials, semi-

conductors, and catalysts by irradiation is presented. (T.R.H.)

12095

RADIATION DAMAGE IN DIAMOND AND SILICON CARBIDE. W. Primak, L. H. Fuchs, and P. P. Day (Argonne National Lab., Lemont, Ill.). Phys. Rev. 103, 1184-92 (1956) Sept. 1.

Diamond and silicon carbide were irradiated in nuclear reactors and were found to be damaged in a manner similar to that for graphite. Detailed observations were made of the dilatation and increase in energy content and their annealing. Dilatations as great as about 3.7 percent and increases in energy content as great as about 400 cal/g were observed. The dilatations and the energy content (release of stored energy) seemed to anneal in a parallel manner and could be treated kinetically as a distribution of processes in activation energy. The initial distribution for diamond showed a peak at about 1.6 ev and a plateau extending (at about $\frac{1}{4}$ the height of the peak at short irradiations and greater proportionately for long irradiations) to activation energies in excess of 3.7 ev. The initial distribution for silicon carbide showed a smaller narrow peak at about 1.6 ev and a very broad larger peak extending from about 2.2 ev to 4.3 ev with a maximum at about 3.4 ev. In many of the samples of irradiated diamond the stored energy exceeded the heat capacity in certain temperature ranges, and catastrophic stored energy release was observed on heating. (auth)

12096

ELECTRICAL RESISTIVITY STUDY OF LATTICE DEFECTS INTRODUCED IN COPPER BY 1.25-MEV ELECTRON IRRADIATION AT 80°K. C. J. Meechan and J. A. Brinkman (Atomics International, Canoga Park, Calif.). Phys. Rev. 103, 1193-1202(1956) Sept. 1.

The electrical resistivity change produced in copper by 1.25-Mev electron irradiation at 80°K has been measured. The recovery of this change upon annealing has been studied. A recovery state centered near room temperature exhibited a phenomenological activation energy of 0.60 ± 0.01 ev and obeyed a second-order chemical rate equation. It is proposed that this state is associated with the annihilation of interstitial atoms and vacant lattice sites resulting from interstitial migration. The present results are compared with those of other workers in an effort to understand the differences in the recovery of the electrical resistivity change produced by electron and cyclotron particle irradiation. (auth)

12097

STRUCTURE OF NEUTRON-DISORDERED SILICA. Ivan Simon (Arthur D. Little, Inc., Cambridge, Mass.). Phys. Rev. 103, 1587-8(1956) Sept. 1.

X-ray-diffraction studies were made of the structure of natural single-crystal quartz plates and of vitreous silica plates which were irradiated by fast neutrons in the MTR to a total integrated flux of 1.4×10^{20} neutrons/cm^2. The distribution of electron density is shown as a function of radial distance from a Si atom in irradiated quartz. (B.J.H.)

12098

RADIATION INDUCED CONDUCTIVITY IN POLYETHYLENE AND TEFLON. R. A. Meyer, F. L. Bouquet, and R. S. Alger (U. S. Naval Raidological Defense Lab., San Francisco). J. Appl. Phys. 27, 1012-18(1956) Sept.

The conductivity induced in polyethylene and Teflon by bombardment with x rays from a 2-Mev Van de Graaff and γ rays from Co^{60} has been investigated as a function of time, temperature, geometry, exposure rate, and applied electric field. Within the range of the variables studied, the observed photocurrents were directly proportional to the exposure rate and the applied electric field. The photocurrent could be divided into three components, the current due to the action of monodirectional photons, the increase in this current due to the influence of the electric field, and a component of less than 10% made up of all other possible charge carriers. During irradiation, the conductivity increased by a factor of about 10^3. Between 78 and 273°K the photocurrent was nearly independent of temperature. In general, the conductivity of Teflon was greater than that of polyethylene. (auth)

12099

EFFECT OF PILE IRRADIATION ON THE DIELECTRIC CONSTANT OF CERAMIC $BaTiO_3$. F. T. Rogers, Jr. (Univ. of South Carolina, Columbia). J. Appl. Phys. 27, 1066-7(1956) Sept.

A specimen of ceramic $BaTiO_3$, made of reagent-grade materials at a calcination temperature of 1250°C, was exposed to pile irradiation in the amount of nvt = $2.1 \cdot 10^{20}$ at Hanford, Washington. The original ceramic showed a peak in the dielectric constant vs. temperature curve usually ascribed to ferroelectricity. After irradiation this peak essentially disappeared, and the dielectric constant was reduced to a nearly constant value over the temperature range 30 to 140°C. This reduced value is about half of the room-temperature dielectric constant as determined before irradiation. Evidence is mentioned for a small residual peak in the dielectric constant of the irradiated specimen. (auth)

12100

X-RAY INDUCED CONDUCTIVITY IN INSULATING MATERIALS. J. F. Fowler (Royal Victoria Infirmary, Newcastle upon Tyne, England). Proc. Roy. Soc. (London) A236, 464-80(1956) Sept. 11.

A co-ordinated explanation of the conductivity induced by ionizing radiation in solid insulating materials (conductivity ~ 10^{-20} Ω^{-1} cm^{-1}), including amber, mica and a number of plastics, is put forward for the first time. A model based on conduction by free electrons and including the presence of electron traps is proposed, and the theoretical predictions based thereon are shown to be in good agreement with the experimental results. The dependence of induced conductivity and of the subsequent decay upon temperature and dose rate have been investigated. Physical parameters are given for each material: recombination cross section, number of traps and their distribution in energy, mean distance diffused by free electrons and probability factors of release from traps. The results suggest that when crystalline regions are present in a material (e.g. polyethylene), the boundaries of these regions provide trapping sites in addition to traps of unspecified nature which are present in completely amorphous materials. (auth)

12101

THE ABSORPTION SPECTRA OF IRRADIATED DIAMONDS AFTER HEAT TREATMENT. C. D. Clark, R. W. Ditchburn, and H. B. Dyer (Univ. of Reading, England). Proc. Roy. Soc. (London) A237, 75-89(1956) Sept. 25.

The absorption spectra of eight type I and three type IIa diamonds irradiated with neutrons, electrons or γ-rays have been recorded at 80 and 290°K after various heat treatments in the temperature range 0 to 900°C. It is found that heating in the range 350 to 450°C causes a general reduction in the irradiation-induced absorption owing to the recombination of those interstitials and vacancies which are near neighbors. Heating type IIa diamonds at 600°C causes a large reduction in the irradiation-induced lines and new lines appear. These are probably due to pairs of identical defects, and the kinetics of their formation during isothermal heating at 600°C are presented. At higher temperatures all absorption lines in

type IIa diamonds disappear and only continuous absorption remains. This is probably due to amorphous or graphitic regions produced by agglomeration of defects. Type I diamonds show the same kind of absorption, but in addition show an increase in strength of the natural lines and also some new absorption lines which are not removed by heating at 900°C. It is suggested that these additional processes are due to the anchoring of vacant atomic sites and interstitial carbon atoms at crystal imperfections present only in type I diamonds. (auth)

RADIOACTIVITY

12102 AECU-3340
Internuclear Co., Clayton, Mo.
USE OF FISSION PRODUCT GAS AS A GAMMA SOURCE. Kenneth A. Hub. May 1956. 6p. A-1 Project. (IC-KAH-56-7). $1.80(ph OTS); $1.80(mf OTS).

Fission gases offer a good source of gamma ray energy, as about 40% of the fission fragments are radioactive gases at one time or another during their lives. There are two types of irradiators, a gas carrier system, where an inert gas is circulated around and carries the fission product off-gas, and where the radioactive gases are absorbed on a charcoal bed at low temperature. (W.L.H.)

12103 AECU-3344
Internuclear Co., Clayton, Mo.
ANALYSIS OF THE EXTERNAL LOOP DECAY FOR A NUCLIDE PRODUCED IN A NUCLEAR REACTOR. Glen E. Putnam. July 2, 1956. 17p. A-1 Project. (IC-GEP-56-11). $3.30(ph OTS); $2.40(mf OTS).

It is assumed that a loop of parent material (material containing a parent isotope which, following neutron absorption, forms a radioactive daughter) is circulated through a high flux region of a reactor. The activity in the section of the loop external to the reactor is analyzed with respect to the behavior of the disintegrations per cm^3, the average specific activity (decays/cm^3 sec), and the fraction of the total disintegrations which take place in the external section of the loop. The major parameters may be defined as the fraction of the total loop volume outside the reactor and the ratio of loop cycle time to the mean lifetime of the daughter. The behavior of the three properties listed are examined with respect to the type of response, the existence of maxima and minima, etc. in response to variations of the major parameters. (auth)

12104
ALPHA DECAY OF SPHEROIDAL NUCLEI. John O. Rasmussen and Benjamin Segall (Univ. of California, Berkeley). Phys. Rev. 103, 1298-1308(1956) Sept. 1.

The consequences of spheroidal deformation of nuclei on the barrier transmission in alpha decay are considered. A set of coupled differential equations is derived relating the amplitudes of the various groups of alpha particles emitted from a nucleus described by the Bohr-Mottelson model. The cases of the decay of Th^{228} and Cm^{242} were studied numerically and from them information regarding the probability distribution of alpha particles on the nuclear spheroidal surface is obtained. It is found that the one-body model of an alpha particle in a well does not yield these distributions, and it is thus concluded that "alpha-particle clusters" have a short mean free path in nuclear matter. The shift in the surface distributions of Th^{228} and Cm^{242} may be explained qualitatively in terms of the order of nucleon orbital filling. The over-all penetration factors for the spheroidal case are compared with those for the spherical case, and it is found that the resultant enhancement due to the deformation is not nearly as large as that predicted by Hill and Wheeler on the basis of a one-dimensional approximation. (auth)

12105
DISINTEGRATION OF Cs^{138}. M. E. Bunker, R. B. Duffield, J. P. Mize, and J. W. Starner (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 1417-22(1956) Sept. 1.

The decay of the fission product Cs^{138} (32.1 minutes) has been studied with beta- and gamma-scintillation spectrometers and a 141-gauss, 180° permanent-magnet spectrograph. Twelve gamma rays were found with energies of 0.1389, 0.1931, 0.2289, 0.4106, 0.4626, 0.550, 0.87, 1.010, 1.426, 2.21, 2.63, and 3.34 Mev. On the basis of coincidence measurements, intensity data, internal-conversion coefficients, angular correlation data, and the above gamma energies, a consistent decay scheme is proposed which involves levels in Ba^{138} at 1.426, 1.89, 2.21, 2.30, 2.44, 2.63, and 3.34 Mev. (auth)

12106
WEAK BRANCHINGS IN THE DECAY OF P^{34}, Cl^{34}, AND P^{30}. H. Morinaga and E. Bleuler (Purdue Univ., Lafayette, Ind.). Phys. Rev. 103, 1423-7(1956) Sept. 1.

The gamma rays following the beta decays of P^{34}, Cl^{34}, and P^{30} were investigated with a NaI scintillation spectrometer and a twenty-channel analyzer. An unsuccessful search was made for a gamma ray with an energy of 3.22 Mev from P^{34} which should result from an allowed beta-decay branching to the second excited state in S^{34}. Since no such gamma ray was found, this branching, if it exists, is very weak, with a log ft value higher than 5.6. Together with the known branching to the first excited state and the transition rates from the Cl^{34} 3^+ isomeric state, the above result suggests that the second excited state in S^{34} has a configuration similar to that of the Cl^{34} isomeric state and that the first excited state resembles the P^{34} ground state. For explaining the transition rate to the ground state from P^{34}, the assumption of strong mixing of both types in the S^{34} ground state seems to be necessary. This strong mixing in the 0^+ ground state also gives an explanation for the inversion of the order of the lowest T = 0 and T = 1 states of Cl^{34}. An additional state of S^{34} at 4 Mev, which is attained from both the P^{34} and the Cl^{34} 3^+ state and is thus to be interpreted as a 2^+ state, was found. In the case of P^{30} a beta-decay branching to the first excited state of Si^{30} was looked for. A weak gamma ray of 2.24 Mev was found, indicating a branching of 0.2% with a log ft of 5.4. (auth)

12107
DECAY OF Eu^{155}, Sm^{153}, Sn^{125}, AND Br^{82}. V. S. Dubey, C. E. Mandeville, and M. A. Rothman (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 103, 1430-41(1956) Sept. 1.

The energies of the β and γ rays associated with the decay of Eu^{155}, Sm^{153}, Sn^{125}, and Br^{82} have been determined by scintillation spectrometry, and coincidence relationships have been investigated when possible. In most instances, values of log ft for the β spectra have been determined from a consideration of the decay scheme and the relative intensities of γ rays. The results obtained have been interpreted as indicating the following excited energy states of the residual nuclei. Gd^{155}: 18 and 102 kev; Eu^{153}: 100, 170, and 700 kev; Sb^{125}: 1070, 1410, 1880, 1970, and 2110 kev; Kr^{82}: 770, 1450, 1800, 2060, and 2620 kev. The results of the measurements have been considered in relation to the single-particle model of the nucleus to ascertain likely spin values. (auth)

12108
ANALYSIS OF THE BETA SPECTRUM AND BRANCHING IN Ho^{166}. G. Alaga and B Jakšić (Institute "Rudjer Bošković" and Univ. of Zagreb, Yugoslavia). Phys. Rev. 103, 1441-2(1956) Sept. 1.

The shape of the β spectrum of the $Ho^{166} \rightarrow Er^{166}$ ground state ($0- \rightarrow 0+$) transition and the branching to the first

excited state (2+) has been investigated. Corrections due to the variation of the lepton wave functions over the nucleus have also been taken into account, and it is shown that under certain conditions these corrections can be sufficient to explain the experimental findings. (auth)

12109

STUDY OF THE γ RADIATION ARISING FROM THE DE-EXCITATION OF THE 8.06-MEV LEVEL IN N^{14}. Pierre Lehmann, Antoine Leveque, and Robert Pick. Compt. rend. 243, 743-5(1956) Aug. 27. (In French)

The γ rays arising from the de-excitation of the 8.06-Mev level in N^{14} have been studied. The ratio of the transitions going through the 3.95-Mev level and ending in the ground state and to the 2.31-Mev level is about $(5.5 \pm 1) \times 10^{-2}$. The E_1 transition between the first two states having T = 1 was found to be reduced by a factor of 20. (tr-auth)

12110

ON THE EXCITATION AND IONIZATION OF ATOMS BY α EMISSION. Fernand Grard. Compt. rend. 243, 777-80 (1956) Sept. 3. (In French)

The probability of excitation and ionization phenomena by α emission was determined by considering the passage of the α particle in the electron shells as a small time-dependent perturbation and by taking into account the sharp recoil of the nucleus at the moment where the disintegration is produced. The result obtained by the Schwartz method is equivalent to that of Levinger to the first order approximation. (tr-auth)

12111

A VERIFICATION OF THE PROBABILITY LAWS FOR RANDOM AND TIME-CORRELATED ALPHA EMISSION. H. Lindeman (Israel Inst. of Tech., Haifa). Bull. Research Council Israel 5A, 135-42(1956) Jan.-Apr.

Measurements on the probability functions for the alpha emission of polonium, the radium series and the thorium series were carried out with a methane flow proportional counter. Disintegrations of polonium and the radium series occurred in good agreement with the Bateman-Poisson law for random emission; those of the thorium series appeared to obey a more complicated probability function, which can be found theoretically as a generalization of the Bateman-Poisson law for cases of time-correlated emission. (auth)

12112

RADIATIONS OF AMERICIUM-246. H. L. Smith, C. I. Browne, D. C. Hoffman, J. P. Mize, and M. E. Bunker (Los Alamos Scientific Lab., N. Mex.). J. Inorg. and Nuclear Chem. 3, 93-103(1956) Sept.

The beta spectra of an equilibrium sample of $Pu^{246}-Am^{246}$ were examined with a magnetic-lens beta-ray spectrometer and a scintillation spectrometer. The $Pu^{246}-Am^{246}$ equilibrium sample and samples of Am^{246} were investigated with gamma-ray scintillation spectrometers. Coincidence studies of the radiations were also performed. The data indicate that the decay of Am^{246} is extremely complex, involving five beta-ray groups and many gamma rays. On the basis of gamma-beta coincidence measurements, the disintegration energy is 2.41 ± 0.10 Mev. (auth)

12113

DETERMINATION OF THE K/β^- RATIO. A. A. Bashilov (Leningrad State Univ.). Nuclear Phys. 1, 629-42(1956) Aug.

A method for determining the relative probabilities of two competing types of radioactive decay—K capture and β^- decay—is described. The method is based on a magnetic spectrometer investigation of the photoelectrons ejected by x rays emitted as a result of K capture and conversion of β^--decay γ rays. The magnetic spectrometer ("coetron") and auxiliary experiments on photoelectrons ejected by x rays emitted by various radioactive sources are described. Results of measurements are presented for Au^{198}: $K/\beta^- < 10^{-4}$ and for Ir^{192}: $K/\beta^- = (4.5 \pm 1.0) \times 10^{-2}$. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

12114

ABSORPTION SPECTRA, ZEEMAN EFFECTS, AND MAGNETIC PROPERTIES OF NEODYMIUM SALTS. G. H. Dieke and L. Heroux (Johns Hopkins Univ., Baltimore). Phys. Rev. 103, 1227-39(1956) Sept. 1.

The absorption spectra of nine neodymium salts were obtained in single crystals at liquid helium temperature and high dispersion. The Zeeman effect of the lines was observed in a field of about 37,000 gauss with different orientations of the crystals, so that the magnetic splitting of the ground and excited states could be measured. This provides valuable clues for the interpretation of the spectra and quantitative data for the derivation of the crystal field. The results are related to those obtained in paramagnetic resonance measurements. (auth)

SHIELDING

12115 NARF-55-85T

Convair, Fort Worth, Tex.

AN INVESTIGATION OF SHADOW SHIELDS IN WATER. J. W. Harris. June 29, 1956. 78p. Project 6(1-9964). Contract AF33(600)-32054 and Ref Contract AF33(038)-21117. (MR-N-106).

Dose rate measurements were made in H_2O at various source-to-detector separation distances along the centerline of the GTR to check their correlation with data previously taken. Also obtained were measurements in which Pb shadow shields were located between the source and the detector to determine the effective shadow-shield cut-off and the attenuation of gamma rays in water. Other measurements were made with Pb shadow shields located between the source and the detector to determine the effectiveness of Pb backed by H_2O for neutron shielding. After-shutdown gamma data were obtained to aid in the predictions of capture gamma dose rates. Centerline gamma dose rate measurements indicate good agreement with previous experimental data. Measurements taken on the centerline behind Pb shadow shields indicate an effective gamma relaxation length of 3 cm for Pb in H_2O; this length is independent of the thickness of the shield and of the position of the detector behind the shield. The results of the shadow-shield investigation indicate that the ratio of the gamma dose rate with Pb shields to that without is a constant 0.6 on a line coincident with the line-of-sight shadow-shield angle to the center of the core. The fast neutron data corroborate previous conclusions that Pb backed by H_2O is as good as H_2O for neutron shielding. (auth)

SPECTROSCOPY

12116 AEC-tr-2486

ON INVESTIGATING UNSTABLE COMPLEX COMPOUNDS IN SOLUTION BY THEIR ABSORPTION SPECTRA. S. A. Shchukarev and O. A Lobaneva. Translated from Doklady Akad. Nauk S.S.S.R. 105, 741-3(1955). 7p.

Chemically pure and non-aqueous $CoBr_2$, $NiBr_2$, LiBr, and acetone were prepared for investigating unstable complex compounds in solution by their absorption spectra. The titration was conducted in a vertical visual colorimeter with six light colored filters with maximum filtration lying

in the area of 420 to 750 mμ. The absorption curves were measured on a quartz differential spectrophotometer. The "formation function" curve of complexes for solutions of $CoBr_2$ + LiBr was obtained by the spectrophotometric method by a calibration curve. (W.L.H.)

12117 AEC-tr-2562
CORRELATION OF THE STATISTICAL AND IMPACT THEORIES ON THE WIDTH OF SPECTRAL LINES. I. I. Sobelman. Translated from Doklady Akad. Nauk S.S.S.R. 98, 43-5(1954). 4p.

12118 AEC-tr-2588
SEVERAL CHARACTERISTICS OF A GASEOUS-DISCHARGE ION SOURCE. E. M. Reikhrudel and A. V. Chernetskii. Translated from Vestnik Moskov. Univ. Ser. Fiz. Mat. i Estestven Nauk, No. 5, 47-53(1954). 7p.

The paper describes a gaseous-discharge ion source. The ions are produced in an impeded glow discharge at low pressure while subjected to an axially-symmetrical magnetic field. The utilization of a specially shaped discharge gap leads to electron oscillations and thus to the effective ionization of the gas by them. The ions are emitted through an orifice in one of the cathodes; they acquire a directed motion in the discharge because of the large cathode potential drop and because of the magnetic field. The paper gives the ion current characteristics as functions of various discharge parameters; the part played by the electron-optical system—cathode-accelerator diaphragm—in forming the ion bunch is examined. (auth)

12119
SEMIAUTOMATIC METHOD FOR SPECTROSCOPIC WAVELENGTH AND INTENSITY MEASUREMENTS. G. H. Dieke, D. Dimock, and H. M. Crosswhite (Johns Hopkins Univ., Baltimore). J. Opt. Soc. Amer. 46, 456-62(1956) June.

An arrangement is described by which spectroscopic wavelength measurements are greatly simplified with an increase in accuracy. The measuring microscope is replaced by a photoelectric scanning device which displays line contours on an oscilloscope screen. The comparator readings are made automatically with electronic devices, and the results either recorded with an automatic typewriter or punched into cards or both. Photographic densities are measured and recorded at the same time. The data are then further processed by electronic calculating machines. The equipment is built largely from commercially available components. Its operation is simple and foolproof. The various stages are independent of each other and can be introduced singly or in combination as desired. (auth)

Refer also to abstract 12101.

THEORETICAL PHYSICS

12120 NP-6108
THE ARRANGEMENT OF PARTICLES IN THE NUCLEUS. DO NUCLEI CONTAIN SHELLS? S. M. Ayub. Jan. 18, 1956. 12p.

The atomic nucleus, a very compact entity in which the mass of the atom is concentrated, is comprised of neutron-proton or/and neutron-neutron couples, which are axis coupled. The particles are neither arranged in the form of a lattice nor shells. The stability of the magic number nuclei is explained by a layer of neutron-proton crosses at their outer periphery. An extra neutron or proton or neutron-proton or neutron-neutron combination in the nucleus weakens the coupling. The theory gets support from the formation of α particles, binding energies and the proposed structure of fissionable nuclei. (auth)

12121
ATOMIC THEORY OF ELECTROMAGNETIC INTERACTIONS IN DENSE MATERIALS. U. Fano (National Bureau of Standards, Washington, D. C.). Phys. Rev. 103, 1202-18 (1956) Sept. 1.

This theory develops a quantum analog of the classical electron oscillator model. It argues first that the Hamiltonian of long-wave excitations of matter is equivalent to that of an assembly of oscillators under very general assumptions. Next, these oscillators are coupled with the electromagnetic field oscillators and the normal modes of the coupled system are analyzed. The normal modes of longitudinal and transverse excitation have different spectra; the transverse frequencies depend strongly on the wavelength but the longitudinal ones do not. If the "longitudinal photons" are eliminated after the transformation to normal modes, the resulting Coulomb law has the dielectric constant in the denominator. The dielectric response law is expressed as a series of oscillations and also in terms of Van Hove's correlation function. Born-approximation theory of the collisions of fast charged particles with the assembly of normal mode (longitudinal and transverse) oscillators yields the same total cross section as Fermi's macroscopic theory. The transverse excitations include the Čerenkov radiation. (auth)

12122
NUCLEAR MANY-BODY PROBLEM. H. A. Bethe (Cavendish Lab., Cambridge, England). Phys. Rev. 103, 1353-90(1956) Sept. 1.

A self-contained and largely new description is given of Brueckner's method for studying the nucleus as a system of strongly interacting particles. The aim is to develop a method which is applicable to a nucleus of finite size and to present the theory in sufficient detail that there are no ambiguities of interpretation and the nature of the approximations required for actual computation is clear. It is shown how to construct a model of the nucleus in which each nucleon moves in a self-consistent potential matrix of the form $(r'|V|r)$. The potential is obtained by calculating the reaction matrix for two nucleons in the nucleus from scattering theory. Some complications arise in the definition of the energy levels of excited nucleons. The actual wave function is obtained from the model wave function by an operator which takes into account multiple scattering of the nucleons by each other. The method of Brueckner is a vast improvement over the normal Hartree-Fock method since, in calculating the self-consistent potential acting on an individual particle in the model, account is already taken of the correlations between pairs of nucleons which arise from the strong internucleon forces. Although the actual wave function is derivable from a wave function which corresponds essentially to the shell model, the probability of finding a large nucleus of mass number A "actually" in its shell model state is small (of order $e^{-\alpha A}$, where α is a constant). The influence of spin is investigated. In the case of an infinite nucleus, an integral equation is obtained for the reaction matrix, just as in the theory of Brueckner and Levinson. The exclusion principle must be applied in intermediate states in solving the integral equation for the reaction matrix. This makes an enormous difference for the solution. When the exclusion principle is used, the scattering matrix is very nearly given by the Born approximation, for any well-behaved potential. Numerical results are given for the case when nucleons interact only in S states, an assumption which leads to saturation without a repulsive core. The agreement with observation is fair to poor, owing to the poor assumption for the interaction. Brueckner's result that three-particle clusters give a small contribution to the energy is con-

firmed, although the numerical value is many times his result; the calculation is then extended to the case of a repulsive core. The dependence of the binding energy on the mass number A is investigated for saturating and non-saturating interactions. Terms of relative order 1/A are calculated, and it is shown that these terms are much smaller than Brueckner and Levinson found, making the method also applicable to relatively small nuclei. Some aspects of the problem of the finite nucleus are discussed, including that of degeneracy. (auth)

12123

NONLINEAR SPINOR FIELD. R. Finkelstein, C. Fronsdal, and P. Kaus (Univ. of California, Los Angeles). Phys. Rev. 103, 1571-9(1956) Sept. 1.

A classical spinor field is defined by a variational principle on a Lagrangian with quadratic Dirac and quartic Fermi terms. Localized (particle-like) solutions are found within a class of comparison functions which made the angular momentum stationary for a given charge. It is found that the existence of eigen solutions depends in a radical way on the parameters of the Lagrangian, but that the observable properties of those solutions which do exist depend little on these parameters. (auth)

URANIUM AND URANIUM COMPOUNDS

12124

PREPARATION OF SCATTERING FOILS OF URANIUM BY EVAPORATION OF THE METAL IN HIGH VACUUM. K. K. Damodaran (Univ. Coll., London). Brit. J. Appl. Phys. 7, 322-3(1956) Sept.

Scattering foils of U were prepared by evaporating U in high vacuum and depositing it on thin backing foils of Al. The average thickness of each foil was determined by direct weighing. The variation in thickness of each of the foils was measured by counting the α and β radiations emitted by U from the various parts of the foil, using a Geiger–Müller counter. (auth)

12125

THE NATURAL ABUNDANCES OF THE URANIUM ISOTOPES. M. Lounsbury (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem. 34, 259-64(1956) Mar.

Using a surface-ionization mass spectrometer, the natural U^{238}/U^{235} abundance ratio in uranium obtained from Great Bear Lake Pitchblende has been measured to be 137.80 ± 0.14. From a survey of results reported in the literature on U^{234} a best value of $17{,}325 \pm 550$ was estimated for the natural U^{238}/U^{234} abundance ratio. The corresponding isotopic abundances are 0.7204 ± 0.0007 atom % and 0.00573 ± 0.00018 atom % for U^{235} and U^{234}, respectively. (auth)

12126

RAMAN SPECTRUM OF UF_6. Howard H. Claassen, Bernard Weinstock, and John G. Malm (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 25, 426-7(1956) Sept.

Two of the 3 Raman-active fundamentals of UF_6 have been observed at 666.6 ± 0.3 (ν_1) and 535 ± 5 cm^{-1} (ν_2) for a gaseous sample. The new value for ν_2 is in good agreement with the value 532 cm^{-1} obtained earlier from infrared combinations. The sample of UF_6 was contained in a Pyrex Raman tube and was irradiated for many hours with 4358 A light with no visible deterioration. Gaunt's thermodynamic functions remain valid. (auth)

12127

NEUTRON RESONANCE PARAMETERS OF U^{235}. V. E. Pilcher, J. A. Harvey, and D. J. Hughes (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1342-52 (1956) Sept. 1.

The neutron total cross section of $_{92}U^{235}$ has been studied for neutron energies between 1.5 and 60 ev by using the Brookhaven fast chopper. The transmission data were analyzed by the "area" method and the Breit-Wigner parameters obtained for the resonances up to 35 ev. The observed level spacing of 0.65 ev is the smallest yet reported for any isotope. The best available fission data have been combined with total cross-section data to obtain Γ_γ. The values of Γ_γ are approximately constant and are consistent with those of neighboring heavy nuclei, whereas the Γ_n^0's have a very broad distribution similar to that observed in a number of other elements. The distribution of Γ_f's is also rather broad and resembles the neutron widths much more than the radiation widths in this respect. Average values of these parameters are presented, together with a discussion of the implications of these findings for current theories of fission. (auth)

PATENTS

CHEMISTRY

12128

ETHER EXTRACTION OF URANIUM FROM SOLUTIONS. A. E. Ballard (to U. S. Atomic Energy Commission). U. S. Patent No. 2,578,007, August 7, 1956.

A solvent extraction method is presented for the separation of small quantities of $UO_2(NO_3)_2$ from aqueous solutions containing large percentages of other metal nitrates, chiefly those of Cu, Fe, Cr, and Ni. The method consists of contacting the solution with diethyl ether to extract the $UO_2(NO_3)_2$. Ordinarily, the distribution ratio for $UO_2(NO_3)_2$ between ether and pure H_2O is less than one, but if the aqueous phase contains a high concentration of some other metal nitrate as well, the distribution ratio is greatly increased and substantially all of the $UO_2(NO_3)_2$ will be taken up by the ether. This property is utilized, and before the solution is contacted with the ether, it is treated so as to increase the concentration of $Cu(NO_3)_2$ by evaporation, or by the addition of a very concentrated solution of $Cu(NO_3)_2$. After the extraction, the ether is stripped of $UO_2(NO_3)_2$ by contacting with water, and is then recycled in a continuous operation. (auth)

12129

PROCESS OF RECOVERING URANIUM FROM ITS ORES. Robert A. Blake (to U. S. Atomic Energy Commission). U. S. Patent No. 2,750,254, June 12, 1956.

Uranium can be recovered from its ores, by leaching the ore with acid, such as H_2SO_4, to obtain the U in solution, treating the slurry so obtained with alkali metal sulfide or hydrosulfide, or H_2S, to precipitate the U as the sulfide and then separating the uranium sulfides in a froth flotation process utilizing a sulfide collector. (auth)

12130

RELEASABLE GRIPPER FOR HOLDING AN ARTICLE SUSPENDED. A. B. Schultz (to U. S. Atomic Energy Commission). U. S. Patent No. 2,751, 229, June 19, 1956.

A gripping device capable of holding a rod-like object suspended in such a manner that release is impossible until the object is completely supported by means other than the gripper was designed. This is accomplished by two sliding cylinders and a number of balls so arranged that when a rod of the required shape is suspended by the device the balls are locked into a necked down portion of the rod. In order for the balls to slide out of the locked position the rod must be raised with respect to the gripper and this can happen only when the rod is supported by exterior means. This device prevents accidental droppage of the gripped object when such droppage may damage

either the object or equipment on which the object may fall. (auth)

12131

PROCESS FOR WATER DECONTAMINATION. A. H. Emmons, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,752,309, June 26, 1956.

A procedure is presented for removing traces of radioactive isotopes, such as certain fission products from H_2O to render it potable. The contaminated water is passed through a column wherein it is successively contacted with activated carbon, steel wool, burnt clay, a cation exchange resin, and an anion exchange resin. (auth)

12132

SOLVENT EXTRACTION OF ZIRCONIUM VALUES. Harley A. Wilhelm, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,753,250, July 3, 1956.

A solvent extraction process is outlined for the separation and recovery of Zr and Hf from acidic aqueous solutions containing both chloride and nitrate ions. The use of an immiscible organic solvent of the alkyl phosphate type, such as TBP, results in substantially complete and clean extraction of the Zr content from an aqueous solution which is about 2 to 2.5M HNO_3 and 1 to 2M $CaCl_2$. The unextracted Hf may be recovered from the aqueous raffinate and the Zr may be recovered from the immiscible solvent layer. (auth)

12133

MIXER-SETTLER. M. E. Whatley (to U. S. Atomic Energy Commission). U. S. Patent No. 2,754,179, July 10, 1956.

A chemical apparatus was designed to facilitate the extraction of metal values by two immiscible liquids. The apparatus consists of a cascade of settling chambers, each connected to the other by a mixing chamber. A dense aqueous solution containing the metal value is intimately mixed with a less dense immiscible solvent such as TBP by an impeller, at which time some of the metal value is extracted by the TBP, and the mixture is pumped into a setting tank where a liquid interface is re-established by gravity, then the liquids are remixed and recycled through successive stages of the cascade until the desired degree of extraction has been attained. The apparatus provides better flow control of each liquid separately and improved mixing of the liquids, resulting in a greater degree of extraction. (auth)

12134

DENITRATION APPARATUS. R. S. Edgett, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,755,853, July 24, 1956.

A denitration apparatus was constructed for use in converting $UO_2(NO_3)_2 6H_2O$ to UO_3 powder. It consists of a kettle, surrounded by a source of heat, fitted with a cover; and an agitator amounted on a vertical shaft, passing through the cover. This shaft is hollow and in it runs a tube through which the UO_3 powder is sucked out of the kettle, after the denitration process is complete. Where the hollow agitator shaft and removal tube pass through the kettle cover, there is a liquid filled labyrinth seal to insure that none of the noxious gases, which are products of the reaction, escape to the atmosphere. There are also vacuum connections in the kettle lid through which these noxious gases are removed to prevent undue pressure from building up in the kettle during the reaction. Since the reaction mass and products may be radioactive, this complete containment of the material within the system is a necessity. (auth)

12135

PROCESS FOR RECOVERING URANIUM AND VANADIUM FROM ORES. D. C. McLean (to U. S. Atomic Energy Commission). U. S. Patent No. 2,756,122, July 24, 1956.

A process for the recovery of substantial amounts of V from U ores is outlined. The ore is leached with an aqueous solution of H_2SO_4 and the U recovered from the leachate by removal on an ion exchange resin. The leach residue containing about 90% of the original V content is then salt roasted, and leached with the original leach solution from which the U has been removed. This second leaching must be performed cold, preferably below 40°C, or the leach solution must have more acid added to keep the pH near or below 1.5. In this manner substantially all of the V in the original ore is obtained as a V rich solution, which may be treated to produce a V-containing precipitate. (auth)

12136

URANIUM–VANADIUM RECOVERY AND PURIFICATION PROCESS. J. H. Yeager, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,756,123, July 24, 1956.

Procedures were developed for the separation of U and V from acidic solutions, particularly phosphatic solutions. The initial step is the addition of an oxidizing agent to the solution to effect the oxidation of the V to the pentavalent state and the U to the hexavalent state. The reason for this is that, when in the higher valence states, both of these metals form anionic complexes. The metals, complexed as anions, are then absorbed on an anion exchange resin. Two methods for the separation of the metals may then be used. The first is contacting the adsorbed metals with a reducing agent such as SO_2 or $FeSO_4$ in aqueous solution which will reduce the vanadium, breaking the anion complex and elute the V as a soluble cation, while not effecting the uranium. After removal of the V, uranium is eluted by means of a HCl solution. The second method is that of selectively eluting the U while leaving the V adsorbed on the exchange resin, and after removal of the U, reducing and eluting the V. (auth)

12137

URANIUM CHLORINATION PROCESS. J. L. Patterson, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,756,124, July 24, 1956.

The production of uranium chlorides by the reaction of UO_3 with CCl_4 is described. A stoichiometric excess of CCl_4 is employed, and after completion of the reaction, the mixture is centrifuged to separate the UCl_4 product from the CCl_4. Uranium pentachloride, also a product of the reaction, is slightly solubie in CCl_4 and is allowed to remain in solution. This UCl_5–CCl_4 solution is recycled as the chlorinating agent, and it is found that the UCl_5 acts as a catalyst and improves the efficiency of the chlorinating reaction. (auth)

12138

CENTRIFUGE SYSTEMS. R. H. Selkirk (to U. S. Atomic Energy Commission). U. S. Patent No. 2,756,925, July 31, 1956.

A centrifuge was specifically designed to handle radioactive materials within a shielded space. This necessitates the basket or receptacle for radioactive material being well removed from the driving motor, and controls which should be relatively accessible for ease of repair. A provision is made for the remote charging and recovery of liquid and precipitate, and for the sealing of shafts and piping to prevent leakage of the dangerously radioactive material. The shafts are composed of sections progressively smaller in diameter toward the socket extending through a bore of like design to reduce the passage of radiation. This design uniquely solves the problems encountered in the remote handling of radioactive material. (auth)

12139

RECOVERY OF FREE AND COMBINED NITRIC ACID FROM METAL NITRATE LIQUORS. N. M. Kapp, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,757,072, July 31, 1956.

Nitric acid can be recovered from the nitrate liquors obtained in U ore processing by a two-step process. In the first step the metal nitrate solution is heated and passed through an evaporator, where most of the H_2O and some HNO_3 are removed. The acid vapors are led into a HNO_3 concentrator and condensed. The residue from the evaporation is hot molten hydrated metal nitrate. The greater portion of this is recycled after mixing with more aqueous nitrate feed solution. The remainder of the molten metal nitrate stream is put into the second or calcining step as feed. The molten nitrate is atomized and mixed with recycled hot (200°F) gases in the calcining chambers. The products of this operation are solid metal oxides, gaseous oxides of nitrogen and water vapor. The solids are separated out in a cyclone. A portion of the gas stream is then drawn off as products and the oxides of nitrogen adsorbed in water to reconstitute more nitric acid. The remaining portion of the gas is reheated and recycled through the calcining chamber. (auth)

12140

AUTOMATIC FILTRATION EQUIPMENT. C. F. Ritchie (to U. S. Atomic Energy Commission). U. S. Patent No. 2,757,799, August 7, 1956.

A stationary filtering apparatus was constructed for the filtering of corrosive liquids, in which the filter cake and sludge are removed by remote operation. The filter is composed of a number of separate elements, each of which is a vertically disposed wire cylinder. A pressure differential is maintained across the filtering surfaces by keeping the filtrate lines under a vacuum, and supplying the feed under pressure. As the filter cake builds up, it is thus held in place on the faces of the vertical filter elements. When the cake has thickened to the point where filtering is inefficient, the feed and vacuum lines are closed off, and compressed air and steam are used to dislodge the filter cake and sludge from the filter surfaces. The sludge then falls into a conical section under the group of filter elements, and is blown from there into a sludge tank by compressed air. (auth)

12141

METHOD OF PURIFYING LIQUID FUELS OF NUCLEAR REACTORS. D. W. Bareis (to U. S. Atomic Energy Commission). U. S. Patent No. 2,758,023, August 7, 1956.

Fission-product poisons can be removed from the fuel of a homogenous reactor utilizing U or a U salt dissolved or suspended in molten Pb or Bi by a liquid–liquid extraction in which the fission-product-containing fuel is contacted with a molten salt of an alkali or alkali earth metal, or a mixture of such salts. Oxygen-containing salts are specifically excluded because at the temperatures encountered the O_2 would react with the heavy metals present. The fission products, particularly the type 4F rare earths, are taken up in the molten alkali metal salt and removed. Mentioned as a preferred embodiment is the use of the eutectic mixture of KCl and LiCl as the alkali salt. (auth)

12142

ELECTRODEPOSITION OF PLUTONIUM FLUORIDE. M. Kahn (to U. S. Atomic Energy Commission). U. S. Patent No. 2,758,963, August 14, 1956.

Thin uniform films of Pu salts were produced electrolytically. A Pt disk is made the cathode, and a Pt wire the anode of an electrolytic cell. The electrolyte is an aqueous solution of $PuO_2(NO_3)_2$ and a large amount of NaF. When the current is passed through the cell the plutonyl ions migrate to the cathode where the Pu is reduced to Pu^{3+} or Pu^{4+}, since there is a large excess of fluoride ions over Pu ions. The reduced Pu is tied up by the fluorine in the neighborhood of the cathode, and, as PuF_3 is insoluble, it precipitates on the platinum disk cathode. (auth)

12143

PURIFICATION OF MATERIALS CONTAINING CHLORIDES. Louis Spiegler (to U. S. Atomic Energy Commission). U. S. Patent No. 2,759,788, August 21, 1956.

A procedure is outlined for the removal of chloride ions from mixtures consisting essentially of uranium oxides, and alkaline earth metal uranates containing small amounts of chloride and fluoride. The uranium-bearing oxide material is intimately mixed into Fe_2O_3 in such amount as to combine with the chloride content. The mixture is then heated in an oxidizing atmosphere at a temperature of about 600 to 1000°C resulting in the formation of volatile $FeCl_3$. (auth)

12144

URANIUM PRODUCTS AND METHODS OF USING. Louis Spiegler (to U. S. Atomic Energy Commission). U. S. Patent No. 2,759,789, August 21, 1956.

Several new uranyl carbonates were prepared and are used in purifying UO_4. The compounds are octavalent uranium–alkali carbonates and are formed when UO_4 is added to an alkali carbonate or bicarbonate solution with a pH between 7.6 and 10.8. The uranium–alkali carbonate compounds, formed in this pH range, are soluble, but the impurities accompanying UO_4, particularly fluorides, are not. Therefore after dissolution of UO_4, the insoluble impurities may be filtered out. After this step UO_4 is precipitated by acidifying the solution to pH between 2 and 5. If all the uranium is not precipitated in this way, the addition of H_2O_2 will usually couple the precipitation. (auth)

12145

PURIFICATION OF MATERIALS CONTAINING FLUORIDES. Louis Spiegler (to U. S. Atomic Energy Commission). U. S. Patent No. 2,759,790, August 21, 1956.

A procedure is outlined for the removal of fluoride impurities from U compounds. The method consists in heating the material to be purified with UO_4 to a temperature between 500 and 1000°C. The UO_4 decomposes to U_3O_8 and liberates O_2, which combines with the fluorides present to form a volatile fluorine oxide. Any metal peroxide would suffice for the purposes of the fluorine oxide formation, but UO_4 is used to avoid contaminating the U compound with another metal. (auth)

12146

PURIFICATION OF MATERIALS CONTAINING CHLORIDES. Louis Spiegler (to U. S. Atomic Energy Commission). U. S. Patent No. 2,759,791, August 21, 1956.

A procedure is outlined for the removal of chloride ions from mixtures consisting essentially of uranium oxides, and alkaline earth metal uranates, containing small amounts of chlorides and fluorides. The uranium-bearing oxide material is intimately mixed with ammonium sulfate in such amounts as to convert the chloride content to ammonium chloride, which is then volatalized from the mixture by heating to a temperature of about 600 to 1000°C for a suitable period of time. (auth)

12147

SOLVENT EXTRACTION APPARATUS USING JET MIXERS. J. H. Yeager, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,759,801, August 21, 1956.

An apparatus was developed for counter-current liquid extractions between liquids of different densities. It is specially designed for the extraction of an aqueous

$UO_2(NO_3)_2$ solution by diethyl ether. The apparatus is a column with decanting chambers attached to both top and bottom. There is a heavy fluid inlet and light fluid outlet connected to the upper decanting chamber, and a light fluid inlet and heavy fluid outlet in the lower decanting chamber. Spaced along the length of the column are several recirculating assemblies, each consisting of a pump, tubing and a jet nozzle to afford thorough mechanical mixing of the two fluids. (auth)

12148

REMOTE HANDLING APPARATUS. H. E. Foskuhl (to U. S. Atomic Energy Commission). U. S. Patent No. 2,760,655, August 28, 1956.

A remote control handling device was devised to move an object from one vacuum chamber to another without breaking the vacuum of either. This is accomplished by a remotely operated forceps, slidably mounted in a container that has a specially designed connection to fit the vacuum chambers. This device permits the operator, working outside of a gas and radiation tight compartment to remove an object from a vacuum chamber, rotate the object as may be necessary for inspection and insert it into another vacuum chamber or carrier. This procedure and device is necessary in handling certain highly radioactive tests foils, although, it could be used equally well in handling chemically active substances. (auth)

12149

IMPROVEMENTS IN OR RELATING TO METHODS OF SEPARATING PLUTONIUM. Frank Morgan. British Patent 754,651. Aug. 8, 1956.

A method is described for separating Pu, U, and mixed fission products including Zr and Nb from irradiated fuel elements. The rods are dissolved in HNO_3 with the addition of nitrates of Zr and Nb as carrier compounds. An aqueous solution of a soluble phosphate is added which causes the precipitation of insoluble phosphates of Pu, Zr, Bi, and Nb. These are treated with oxalic acids and Zr and Nb are rendered soluble leaving an insoluble residue of Zr and Bi oxalates. These may be separated by several methods. (F.S.)

ENGINEERING

12150

HEAT-EXCHANGER PUMP. L. B. Vandenberg (to U. S. Atomic Energy Commission). U. S. Patent No. 2,748,710, June 5, 1956.

A combined heat exchanger and liquid metal pump suitable for use as the connecting means between the primary liquid metal and secondary liquid or gas cooling systems of a nuclear reactor was designed. The two fluids flow through banks of adjacent interspersed tubes which are connected to headers, the interstices being filled with a good heat conductor such as Cu. The Na tubes are so designed that thermocouples are created, connected in series so that sufficient current is generated to set up an electromotive force acting upon the liquid metal resulting in circulation of the primary coolant. The circulation of the secondary coolant is achieved by any common system such as a condenser. The heat exchanger pump is designed to enclose a reactor and radiation shield resulting in a compact self regulating reactor power unit. (auth)

12151

INSPECTION CONVEYING APPARATUS. F. B. Quinlan (to U. S. Atomic Energy Commission). U. S. Patent No. 2,758,706, August 14, 1956.

A conveying device was constructed that imparts a rotational as well as transletional motion to the cylindrical object being conveyed. The rotational motion aids in the inspection of the transported object. The apparatus includes a rotating drive shaft, three pairs of idlers driven by the shaft and distributed axially along the shaft, and a means for tilting each idler from the normal position to the shaft, and each idler of the pair oppositely. The speed of conveyance depends on the degree of idler tilt which is mechanically controlled by the system of rods and levers. This apparatus greatly aids the automatic inspection of reactor fuel slugs. (auth)

12152

LEAK DETECTOR FOR PIPE JOINT. T. R. Spalding (to U. S. Atomic Energy Commission). U. S. Patent No. 2,759,175, August 14, 1956.

A leak detector was developed for the joints of a pipe carrying a liquid, the loss of which is undesirable either because of its value or its toxic effect on personnel. A perforated layer of electrically insulating material is secured about the joint, then an electrically conducting foil, and finally a moisture proof outer covering to prevent erroneous signals due to condensation. An electric potential is impressed between the foil layer and the pipe resulting in an open circuit that may be closed only by leakage from the pipe. Any current flow between the pipe and the foil will close a relay and sound an alarm. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

12153

ELECTROPOLISHER. C. A. Kienberger et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,751,344, June 19, 1956.

An electropolishing device was designed to produce upon a metal disk a perfectly smooth surface. The disk, acting as an anode is immersed in an electrolyte, a cathode is adjustably positioned with respect to the disk and an electric current is impressed upon the cell. The metal passing in the solution erodes from peaks or raised portions of the surface resulting in the formation of a super smooth surface. These surfaces are necessary in a process used for isotopic analysis of U. (auth)

12154

PROCESS OF VACUUM REFINING URANIUM. G. Meister (to U. S. Atomic Energy Commission). U. S. Patent No. 2,756,138, July 24, 1956.

An impure U slug is supported upon a strainer which is placed in a crucible with a hole in its bottom. Under the crucible is a mold, and the entire assembly is enclosed in a vycor glass envelope. The envelope is evacuated and an induction coil, wrapped around the outside of the envelope, is used to heat and melt the U. As the U melts, the volatile impurities vaporize and are condensed on the inner surface of the glass envelope. The non-volatile oxide and fluoride impurities form a slag which is retained on the strainer when the melting U flows through it. The molten U passes through the hole in the crucible and is cast in the mold below as pure metal. (auth)

12155

METAL ALLOY. Howard E. Morris (to U. S. Atomic Energy Commission). U. S. Patent No. 2,756,489, July 31, 1956.

Uranium–chromium alloy, in which Cr constitutes from 1 to 20%, by weight, was prepared. This alloy has excellent corrosion resistance making it particularly useful in the fabrication of fuel elements for nuclear reactors. (auth)

12156

METHOD OF DISSOLVING BINARY ALLOYS. Harold M. Feder, Robert P. Larson, and Harold B. Evans (to U. S. Atomic Energy Commission). U. S. Patent No. 2,758,024, August 7, 1956.

Uranium–zirconium alloys were dissolved rapidly and safely by an aqueous solution which is 7 to 15M in HNO_3, 0.02 to 0.05M in HF, and 0.5 to 1.5M in $Al(NO_3)_3$. (auth)

12157

PROCESS FOR PRODUCING STEEL BY ELECTRO-FORMING AND CARBURIZATION. John F. Lakner (to U. S. Atomic Energy Commission). U. S. Patent No. 2,758,950, August 14, 1956.

Thin-walled steel objects of complicated shape were fabricated without resorting to a machining operation. The method comprises preparing a desired shape of mandrel from a refractory carbide, such as one of Ti, W, Zr, Cr, or the like, electrodepositing a layer of Fe of suitable thickness thereon, and subsequently carbonizing the same in situ. By so doing, one avoids any warping of the steel object as well as any fusion to the mandrel. (auth)

12158

PROCESS OF TREATING STEEL. H. F. Priest (to U. S. Atomic Energy Commission). U. S. Patent No. 2,759,886, August 21, 1956.

A process for forming, on steel, a coating which is non-conducting and which is impervious to attack by F_2 or F containing compounds is outlined. This coating is formed by an electrolytic treatment. The piece of steel to be treated is made the anode of the cell and the electrolyte is molten KHF. Gaseous HF is continually bubbled into the electrolyte to keep it liquid. After the current has passed through the cell for a short period of time it will be found to drop, indicating that the formation of the desired non-conducting coating of ion fluoride is complete. (auth)

12159

METHOD OF ALLOYING REACTIVE METALS WITH ALUMINIUM OR BERYLLIUM. To: Atomic Energy of Canada Ltd. British Patent 751,441.

Halides of Np, Ce, or Am are mixed with Al or Be and the mass heated to 700 and 1200°C in a vacuum of about 10^{-3} mm Hg until the metal is reduced and alloyed. (F.S.)

12160

METHOD OF CHEMICALLY CLEANING THE SURFACE OF ARTICLES OF ZIRCONIUM OR HAFNIUM OR ALLOYS THEROF AND OF APPLYING ADHERENT ELECTRO-PLATES TO ZIRCONIUM OR HAFNIUM SURFACES OR TO THE SURFACES OF ALLOYS OF THESE METALS. To: U. S. Atomic Energy Commission. British Patent 752,940.

It has been found that the metals can be cleaned by etching their surfaces with an aqueous solution of ammonium fluoride and hydrofluoric acid. On the cleaned surface can be electroplated an adherent coating of other metals. The composite article is then heat-treated. (auth)

PHYSICS

12161

LEAKAGE TESTING APPARATUS. R. F. Plott (to U. S. Atomic Energy Commission). U. S. Patent No. 2,751,780, June 26, 1956.

An apparatus for testing canned fuel slugs for the gas tight integrity of the closure is described. A transparent closed end tube receives the slug to be tested after it has been coated with a bubble forming substance such as a soap solution or kerosene. The open end of the tube is connected to a vacuum pump and the air pressure surrounding the slug is substantially reduced. Any imperfections of the closure will then be revealed by the formation of bubbles caused by the entrapped air or gas in the slug. The defective slug may be recanned or repaired immediately obviating the danger of subsequent swelling and plugging the reactor core thereby causing costly repairs and shutdown time of the reactor. (auth)

12162

DIRECTIONAL COUPLING MEANS FOR TRANSMISSION LINES. B. J. Bittner (to U. S. Atomic Energy Commission). U. S. Patent No. 2,749,520, June 5, 1956.

An improved coupling device used to couple together high frequency transmission lines such as coaxial conductors or wave guides with relatively high directivity and relatively broad band width is described. The coupling comprises two generally tubular conductors connected by any standard means to the transmission lines. The tubular conductors have a common wall spaced with slots, and probes retained by plastic inserts, cross the common wall at right angles to the axis. The slots and probes provide effective coupling of the coaxial lines, and by reason of the fact the slots and probes are at identical locations a series and parallel coupling effect is obtained. (auth)

12163

LINEAR PULSE INTEGRATOR. W. R. Aiken (to U. S. Atomic Energy Commission). U. S. Patent No. 2,750,500, June 12, 1956.

A linear pulse integrator is described which produces a voltage proportional to input pulse frequency over a wide frequency range. Standard integrating elements are employed in this simple circuit which provides for double integration so that the unavoidable error of the first integration is integrated to produce the correct integrator signal. (auth)

12164

ELECTROSTATIC MEASURING DEVICE. A. S. Langsdorf, Jr. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,750, 520, June 12, 1956.

Electrostatic measuring devices capable of alternately measuring a plurality of electrical potentials existing at adjacent localities, such as the potential magnitudes of the negative and positive charges present on a moving belt of a Van de Graaff generator were developed. The devices, comprising a stationary cylindrical member surrounded by a rotatable sleeve having a series of openings therein, may be positioned between opposing halves of an electrostatically charged movable belt. By rotating the sleeve, the stationary member will be alternately exposed through the openings therein to the charges on both halves of the belt and will have different charges induced thereon. Appropriate instruments measure the magnitudes of such induced charges to give an indication of the electrostatic charges present on both of the opposing portions of the movable belt. (auth)

12165

PARTICLE TRAJECTORY PLOTTER. B. H. Rankin (to U. S. Atomic Energy Commission). U. S. Patent No. 2,751,273, June 19, 1956.

Mechanical devices for automatically tracing the path of a charged particle upon the plot of a non-uniform magnetic field are described. Provision is made for altering operation conditions of the devices to meet variations in the type of particles and also their velocity. This analogue machine comprises in part a self-propelled carriage which may be remotely controlled to move along a path similar to that followed by a charged particle traveling transversely of a magnetic field and thereby obtaining a solution to the equations of motion for the charged particle. (auth)

12166

NEUTRONIC REACTOR DEVICE. H. L. Anderson (to U. S. Atomic Energy Commission). U. S. Patent No. 2,751,505, June 19, 1956.

A continuous wire scanner provides a means for recording the instantaneous power output of a nuclear reactor. An endless tape of some material, the radioactive isotope of which has a relatively short half life, e.g., Ag, Cu or In, is exposed to neutron bombardment in or near the core, then is run outside the shield to a suitable counter such as a geiger

counter, where the activity level is recorded. The short lived radioactivity is allowed to decay prior to reentry into the core by passing the tape back and forth over a number of pulleys for a sufficient length of time. This simple device gives a fast accurate and continuous indication of the neutron flux level existing in a reactor. (auth)

12167

METHOD OF MAKING AN ELECTRONIC GRID. W. E. Glenn et al. (to U. S. Atomic Energy Commission.) U. S. Patent No. 2,751,662, June 26, 1956.

A method of making an electronic grid in which the grid wires are placed under a permanent tension so that in subsequent operation the wires will maintain their parallelism is outlined. Grooves are cut into a relatively soft metal such as copper, that slope outward toward the circumference. A mandrel, upon which relatively hard wire, e.g., W, is parallelly wound, is sandwiched between two of the rings previously described and pressure is exerted so as to imbed the wire in the rings; the pressure deforming the sloping grooves so that the entire face of the ring tends to move outward thereby stretching the wire. Before removing the pressure the wire is cut from the mandrel and further imbedded in the ring by grinding. This grid will withstand high temperatures without danger of warping or breakage of the wires, while maintaining the parallel structure of the grid wires. (auth)

12168

COUNTING-RATE METER. G. V. Zito (to U. S. Atomic Energy Commission). U. S. Patent No. 2,752,508, June 26, 1956.

A counting-rate-meter circuit was modified to produce voltage pulses of uniform width and amplitude in response to random pulses from a Geiger-Mueller tube. The circuit includes a multivibrator for producing uniform pulses with the output thereof connected directly to an integrating circuit without using an amplifier stage. The use of a choke coil as the load resistor in the output of a relaxation oscillator provides high voltage without using an amplifier. (auth)

12169

NEUTRON FLUX MEASURING DEVICE. J. W. Moyer, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,753,462, July 3, 1956.

A neutron flux measuring device is described which may be small in size and of any desired shape and is useful in measuring low neutron fluxes without serious noise problems. The device comprises means including P- and N-type regions with an intermediate P-N junction, a layer or material for yielding alpha particles under neutron bombardment overlying an outwardly disposed surface of the P-type region at a location spaced from the P-N junction, and separate conductors directly connected with the N-type and P-type regions at locations spaced from the intermediate P-N junction for connection with an indicating instrument. (auth)

12170

SOURCE OF HIGHLY STRIPPED IONS. E. J. Lofgren, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,754,422, July 10, 1956.

An ion source is described for producing multiply-charged ions, such as C^{6+} ions. The source consists of means for establishing a high energy electron beam, evacuated housing for enclosing and containing non-volatile material to be ionized, and procedures for directing the electron beam into the housing and upon the material to produce the multiply charged ions. (auth)

12171

CALUTRONS OF THE MULTIPLE ION BEAM TYPE. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent No. 2,754,423, July 10, 1956.

Design modifications of a calutron of the multiple-ion-beam type are outlined. The single transmitter unit consists of a plurality of mutally insulated gas ionizing devices supplied with gas to be ionized from a single chamber arranged to transmit a plurality of ion beams traversing paths of different curvatures. Means are provided for focussing the ion beams onto the receiver to collect the separated isotopes. (auth)

12172

NEUTRON SCINTILLATION DETECTOR. Carl O. Muehlhause and George E. Thomas (to U. S. Atomic Energy Commission). U. S. Patent No. 2,755,253, July 17, 1956.

The scintillators exist in the form of solutions consisting of a solvent, a phosphor, and a "radiator". $Boron^{10}$ gives rise to an α particle when it is struck by a neutron, and so the "radiator" is an alkyl borate. The charged particles, produced when neutrons collide with this alkyl borate, react with the solvent and the phosphor to produce scintillations which are counted by a photomultiplier. The solvent is selected from a group of organic liquids most of which contain a single phenyl group and an alkyl side chain and the phosphors are, in general, complex aromatic compounds having a high proportion of double bonds. A list of various phosphor and solvent compounds is given. The mechanism of the reaction between the charged particle, the solvent and the phosphor is not fully understood, and not all possible solvent–phosphor combinations yield good results. Several preferred embodiments are noted, in one of which the radiator is trimethyl borate, the phosphor is terphenyl, and the solvent is xylene. (auth)

12173

GROUND INDICATOR FOR CALUTRONS. C. C. Waugh (to U. S. Atomic Energy Commission). U. S. Patent No. 2,755,387, July 17, 1956.

A circuit for testing and maintaining the electrical integrity of an ion receiver used in a calutron was developed. Ions of the desired material enter the receiver, where they are electrically discharged and removed. To properly control the calutron it becomes necessary to know the rate at which the material is received. This is best indicated by the current flow from the receiver caused by the discharging of the ions. Deposition of an electrically conductive substance that shorts out the discharging electrode to ground is a common occurrence in operation. The circuit arrangement of this patent provides a direct indication of such shorting by means of a cathode tube and in addition provides a source of high voltage current that may be impressed between the electrodes and ground so that the shorting material will be burned out. (auth)

12174

IONIZATION CHAMBER. J. J. Keyes, Jr. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,755,391, July 17, 1956.

An ionization chamber was designed to continuously monitor the radioactivity level of a flowing gas, and is useful in an air duct to detect the presence of extremely small amounts of radioactive contamination in an air supply system. The ionization chamber receives all or a portion of the air supply, and passes this air between two electrodes. Any radioactive substance carried in the air will ionize the air proportional to the level of radio activity, and thus permit a correspondingly proportional flow of electric current thus giving an electrical signal that may be coupled to any suitable alarm system. A non-radioactive gas such as nitrogen or dry air is forced at slight pressure between each of the electrodes and between the electrodes

and the outer casing so that no radioactive material will accumulate between the electrodes to short out the current. This feature permits use over a long period of time without danger of false signals. (auth)

12175

COUNTING RATE METER. H. D. Gulnac (to U. S. Atomic Energy Commission). U. S. Patent No. 2,755,441, July 17, 1956.

Circuitry is presented for a counting rate meter in which the impressed or signal voltage is approximately one hundredth as large as heretofore has been necessary. In order to use standard equipment the signal voltage has been in the neighborhood of 2000 v; by means of this circuit a signal of approximately 25 v is sufficient, permitting the use of smaller, less costly and less dangerous equipment. In previous circuits it has been necessary to use this high voltage to overcome the cumulative buildup of the rectifier bias voltage. To eliminate this necessity the return leg of the rectifier is connected to the output side of the vacuum tube volt meter. This change compensates the milliammeter for the bias voltage buildup, resulting in the previously described advantages. (auth)

12176

POSITIONING DEVICE. W. H. McCorkle (to U. S. Atomic Energy Commission). U. S. Patent No. 2,756,857, July 31, 1956.

A reactor control-rod positioning device was developed that is capable of a slow accurate positioning obtained by a screw and nut arrangement, as well as a rapid motion, such as is necessary in a scram operation where the control rod must be inserted as quickly as possible. The latter being provided by the pneumatic cylinder acting upon a cam and pivot arrangement. This affords considerable leverage and allows the rod to be used both as a control rod and a scram rod. (auth)

12177

FUEL CHARGING MACHINE. K. Kasschau (to U. S. Atomic Energy Commission). U. S. Patent No. 2,756,858, July 31, 1956.

An apparatus useful for feeding fuel slugs into vertical tubes of a nuclear reactor is described. The device is simply a rotatable arm with an articulated extension controlled and positioned by means of a gear train. The extension holds a flexible tubing through which the slugs are forwarded by a flexible ram. Since the tube openings are disposed in a circular area all tubes may be loaded by some combination of the relative position of the arms. The tube openings are sufficiently well indexed so that the charger may be accurately positioned from a remote position without visual aid. (auth)

12178

COMPUTING DEVICE. G. T. Pelsor, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,756,930, July 31, 1956.

An electro-mechanical, optical computer which was designed to indicate probable bomb damage to a particular target under predetermined or assumed conditions is described. By altering the variables in repeated trial and error tests a conclusion may be drawn as to the expected damage to the target and the type of bomb and manner of delivery most likely or economical to produce the desired results. Two masks, one representing the type of bomb and the other representing target characteristics, are mechanically moved between a light source and a photo electric cell. Variables such as expected aiming error and target vulnerability are introduced as functions of speed as the masks are moved. The light rays passing through the two moving masks are condensed by a convex lens to fall upon the photo electric cell. The voltage produced is representative of the probable damage. This device is a simple convenient means for estimating results otherwise obtainable only by considerable mathematical computation or by actual trial. (auth)

12179

ISOTOPE ENRICHMENT PROCESS. J. M. Carter, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,758,006, August 7, 1956.

An improved method is suggested for processing material enriched in a particular isotope by means of two stages of electromagnetic separation. The non-enriched material from the first stage calutron and the depleted material from the second stage calutron are combined and reworked as feed to the first stage. Likewise, the non-enriched material from the second stage and the enriched material from the first stage are combined and used as feed to the second stage. The enriched material from the second stage calutron is recovered as product. (auth)

12180

CALUTRON RECEIVER. B. Peters (to U. S. Atomic Energy Commission). U. S. Patent No. 2,758,213, August 7, 1956.

An ion receiver or pocket for collecting the desired material that has been separated electromagnetically in a calutron is described. This improved receiver has a face sloping away at 45° from the ion path. A shield over the receiver has a slit located at the mean point of impact allowing the desired ions to pass into the receiver where they are discharged and removed. Ions not entering the slit are discharged and scattered by the shield, the discharge being measured by an electrode in electrical contact with the shield. (auth)

12181

TIME-OF-FLIGHT MASS SPECTROMETER. W. E. Glenn, Jr. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,758,214, August 7, 1956.

A mass spectrometer was designed to separate ions of different mass on the basis of their linear acceleration rather than the conventional method of magnetically dispersing their paths. Ions of several substances each having a different characteristic mass, produced by conventional means at one end of an evacuated tube are accelerated directionally by timed electrical pulses to the other end of the tube where a suitable receptacle is placed. Owing to the different masses the ions tend to bunch themselves in travel resulting in their arrival at the target in groups of like mass, ions of lighter mass accelerating faster than the heavier ions. An intervening grid can be charged so as to repel the ions before impinging on the target, and by selective timing this grid can repel all groups of ions except those of the desired mass passing through the repelling grid at a period when the grid is uncharged. (auth)

12182

PULSE ANALYSER. P. R. Bell (to U. S. Atomic Energy Commission). U. S. Patent No. 2,760,064, August 21, 1956.

An electrical pulse analyzer was designed to give an accurate indication of when the pulse conforms to certain preselected requirements. This function is particularly useful in proportional and scintillation counters which are extensively used in the nuclear field. In order to indicate the pulses above one selected threshold but below another, two channels are used each having a pulse height discriminator. The channel having the lower level discriminator has a delay circuit built in to compensate the time delay between passage of the two thresholds. The channel of the higher discriminator has a storage section to compensate for the shorter duration of the pulse seen by that circuit.

An anti-coincidence circuit places these impulses in opposition so that output signal is produced only when the pulse crosses the lower but not the higher discriminator level. (auth)

12183

ARRANGEMENT FOR MINIMIZING NEGATIVE SIGNALS. J. T. Dalton, et al. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,760,076, August 21, 1956.

An ion collector of a mass spectrometer was designed to over come inaccuracies in analysis and/or calibration caused by negative signals. This is accomplished by removing from the ion beam to prior collection stray electrons, negative ions or other particles carrying a low charge. The collector has a number of plates containing aligned apertures through which the selected ion beam must pass before impinging on the collector electrode. A magnetic field is created in the region of these plates that will cause the undesired lowly charged particles to deviate and strike the plates which are grounded, thus effectively removing the undesired particles from the ion beam and thereby enhancing the selectivity of the mass spectrometer. (auth)

12184

METHOD AND APPARATUS FOR MEASURING ELECTRICAL CURRENT. Q. A. Kerns (to U. S. Atomic Energy Commission). U. S. Patent No. 2,760,158, August 21, 1956.

A method is outlined for measuring both an alternating current and unidirectional current flowing in the same wire when it is not desirable or feasible to insert by direct connection a measuring device into the circuit carrying the current. The a-c component is measured by transformer type inductance cores and windings placed about the conductor. The unidirectional component is measured by a combination of a radio frequency generator to form a magnetic flux opposing that which is about the conductor and a wheatstone bridge circuit to establish a null when the flux of the conductor is counteracted. The two signals are integrated in a voltmeter to give an indication that is a function of both components of the unknown current. (auth)

12185

ELECTROSTATIC MEMORY SYSTEM. J. H. Bigelow (to U. S. Atomic Energy Commission). U. S. Patent No. 2,761,063, August 28, 1956.

An electrostatic memory system was developed for storing and recovering information on the surface of cathode ray tubes. The information is represented by an intensification of the electron beam as distinguished from the unintensified beam. Storage of information is normally accomplished by displacing the beam slightly to one side of the normal position. It is desirable that this be done without disturbing other nearby raster points, i.e., points where the electron beam strikes the screen of the cathode ray tube; likewise it is desirable to maintain the maximum number of raster points per unit surface area. This invention involves the placing of the disturbed raster points alternatively to one side and then the other of the undisturbed points, and doing it in accord with a preconceived system so that the points may be identified. This method will store the information with a minimum disturbance to other points and yet maintain the maximum number of points on the screen. (auth)

12186

FAST NEUTRON DOSIMETER. G. S. Hurst (to U. S. Atomic Energy Commission). U. S. Patent No. 2,761,071, August 28, 1956.

An ionization chamber-proportional counter was designed to give an accurate indication of the amount of energy absorbed by living cells when irradiated by fast neutrons. The combination of ethylene gas in a polyethylene container was selected as the material most nearly approximating living cells in absorption of radiation energy. Since in practice radiation does not come from a penpoint source the chamber was designed to respond to radiation unlimited as to directional incidence as in fact are living cells. Further the dimensions of the ionization chamber and the thickness of the polyethylene container were critically selected to discriminate between gamma and neutron radiation, and between fast and slow neutrons. (auth)

12187

NEUTRON SOURCE FOR WELL-LOGGING APPARATUS. Schlumberger Well Surveying Corp. British Patent 729,613. May 11, 1955.

A rugged source of substantially monoenergetic neutrons consisting of a miniature ion source, accelerator, h.v. supply, detector unit, permanent magnet, and a target for D-T or D-D reactions is reported. (F.S.)

12188

IMPROVEMENTS IN OR RELATING TO METHODS OF PRODUCING RADIOACTIVE PREPARATIONS FROM METALS OR METAL ALLOYS MADE RADIOACTIVE BY NUCLEAR REACTOR. To: N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands. British Patent 750,815.

12189

NUCLEAR REACTOR. To: Stichting voor Fundamenteel Onderzoek der Materie, Netherlands. British Patent 751,152.

A heavy-water moderated reactor is described that obtained good insulation between the space for the moderator and the space where nuclear fission occurs by coating the walls on the moderator side with a low porous material of low neutron absorption capacity. Loosely sintered BeO_2 was suggested for the coating and tightly sintered BeO_2 for the wall. (F.S.)

12190

NUCLEAR REACTOR. To: Stichting voor Fundamenteel Onderzoek der Materie, Utrecht, Netherlands. British Patent 751,429. June 27, 1956.

A non-boiling reactor contained in a pressure shell is described to help solve pressure, heat and γ radiation problems. (F.S.)

12191

NUCLEAR REACTOR. Stichting voor Fundamenteel Onderzoek der Materie, Utrecht, Natherlands. British Patent 752,152. July 4, 1956.

A heavy water reactor is described with walls of a good heat insulating capacity, without the neutron capacity rising to inadmissible values, by coating, the moderator side with a porous material which possesses a low neutron absorption capacity. Carbon or Al_2O_3 may be used but BeO_2, loosely sintered gives better results. (F.S.)

12192

ATOMIC ENERGY-PRODUCING DEVICES. S. G. Bauer and R. E. Newell. To: U. K. Atomic Energy Authority. British Patent 753,130.

The control of a heterogeneous boiler, moderated by heavy water with vapor or ordinary water coolant is accomplished by controlling the level of the moderator fluid in the boiler while the coolant within the tubes can be circulated past the rods at any desired temperatures and velocities. Using a separate cooler for the moderator, the temperature in the boiler can be kept lower than the coolant, reducing the critical size of the system. (F.S.)

12193

PROCESS OF NUCLEAR FISSION. To: Stichting voor Fundamenteel Onderzoek der Materie, Netherlands. British Patent 753,399.

To overcome the neutron-capturing properties of impurities which have an unfavorable effect on a chain reaction, nuclear fuel in the form of a stable suspension in which no agglomeration of particles occurs is used. Suitable suspensions may be effectively separated in a hydroclone thickener if the mean effective diameter of the solid particles is equal to or greater than 1 micron. (F.S.)

12194

NUCLEAR-CHAIN REACTOR. To: Allmanna Svenska Electriska, AB, Sweden. British Patent 754,183.

A reactor is shown that uses heavy water as a moderator at atmospheric pressure at a temperature below 100°C in which U (Th or U–Th) is used as fuel in the form of hollow rods in Zr or Al pipes internally cooled by Na. (F.S.)